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Number 12

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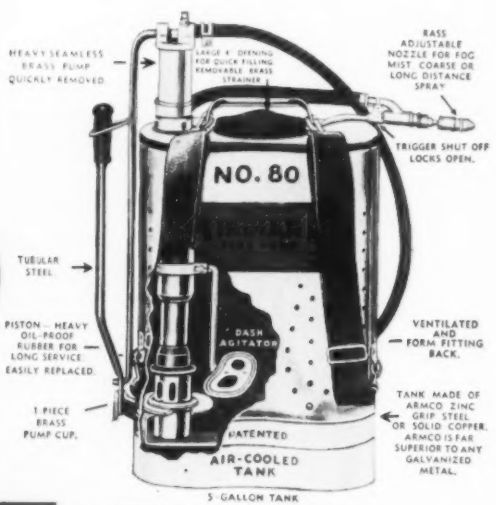
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Photo courtesy Weyerhaeuser Company

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Journal of Forestry

Official Organ of the Society of American Foresters

Problems of Forestry in the Philippines[1]

Tom Gill

TWO FACTS, I believe, are basic to the forest situation in the Philippines. The first is the existence of magnificent forests, equal to any in the world. The species are well and favorably known. The forests, if cut with reasonable care and protected, will reproduce themselves naturally so that this source of national wealth need never cease, and the great forest industries need never fear the day when the last log rolls down to the mill. All these are favorable factors that many a country would give a great deal to possess. So that I think this is the first fundamental fact we have to deal with — magnificent forests capable of producing wealth and jobs for all time.

The second fundamental fact is that these forests are being destroyed faster than in any country in the world. Now the great bulk of this destruction is not and should not be the result of logging, for logging under proper management is the orderly harvesting of a ripe crop and making ready for another harvest to follow. The destruction I speak of here is the work of the squatter and kainginero,[2] and the only harvest he prepares is burned, abandoned, and wasted hectares.

Forest Destruction

There are reasons and excuses for this destruction—the most popular being population pressure and the need for expanded food production. But it may be well to see if this wastage is really solving any problems and what the cost is likely to be. For the loss of the forests themselves, serious as that is, may not be the worst. It is the destruction of the soil itself that often follows, and the soil is the basic source of the world's wealth. Not wealth in temporary things such as pesos or dollars and Cadillacs, but wealth in its real and fundamental sense of something necessary for our very existence.

Some weeks ago, I flew over and visited Cebu, Bohol, and Negros. Parts of these islands made me think of Korea, North China, or the man-made deserts of Mexico. For there I saw thousands upon thousands of hectares of cutover, burned-over, and abandoned land, pock-marked with red and yellow scars of bare earth at the mercy of sun, wind, and rain. This was the trail of the kainginero. I have seen it all over the tropical world. It will take a long, long time and many million pesos before these hectares ever add one centavo to the national wealth or one handful of corn to the food supply. Yet these same hectares might have been a permanent source of wealth and employment.

So here in the Philippines it is not an academic question as to what may happen if the forests are destroyed. In too many places it already has happened. Hectares which once supported one of the finest timber types the world knows are now useless; not only useless but a menace to the agricultural land below, wherever erosion has begun to claw away the soil of the steep slopes and hurl it down upon the croplands of the valley.

This creation of man-made deserts has been going on since prehistory. North Africa once supported a prosperous agriculture and proud cities. They probably felt that their culture and their civilization were as permanent as we do here. Maybe more, for they had not the advantages of the atom bomb. But first they cut the forests at the headwaters of their streams, then they completed the wreckage with herds of goats, then water ceased flowing out of the hills, their cities died of thirst, and today the silence of the desert holds all that once fertile, once populous land.

Now I know that forest devastation is not happening to every hectare in the Philippines, but it is going steadily on—and with an ever-upward curve. The rhythm of destruction is heightening, and if history has any lesson for us, it is that there comes a point in the wreckage of forest resources when human life just is not worth the effort, and the region is abandoned.

The Industries

Well, so much for what is happening to the forests. Now what is happening to the forest industries, the third major export industry in the country, industry

THE AUTHOR is executive director, Charles Lathrop Pack Forestry Foundation, Washington, D. C.

[1]Adapted from a talk before the Philippine Lumber Producers Assn. and the Manila Hoo-Hoo Club, February, 1959.

[2]Kainginero. A Filipino farmer who follows an age-old type of agriculture known as shifting agriculture. Under this system the farmer burns the trees on a few acres of forest soil, and on the land—the kaingin—thus liberated to sunlight and fertilized with wood ash, plants his crops. At the end of a few years, soil exhaustion, erosion, or the invasion of weeds prevent further cultivation. So the land is abandoned, and another patch of forest is burned, cut, and seeded. Every several years this process is repeated, and has wrecked millions of acres of tropical forests in both hemispheres.

that gives direct livelihood to nearly half a million people? Here, as in the case of the forests themselves, industry suffers from a complete lack of stability. Companies with concessions[3] have very little security either as to the amount of timber they can count on or the number of years they can stay in business. Squatters riddle the concessions practically at will, reducing the available supply of timber, making it necessary to revise cutting plans, making efficient management practically impossible, and jeopardizing the entire economic outcome.

In addition to the lack of certainty as to the quantity of timber available, many logging companies find it difficult to obtain the long-term concessions necessary to justify the investment. I do not know of any other country in the world that imposes this unnecessary hardship. It adds an extra hazard to a business that is hazardous enough, adds enormous difficulty to practicing sustained yield, and would seem to serve no legitimate end.

The situation of the timber concessionaire today is a little like that of a man who signs a contract of employment for ten years at 20,000 pesos a year. So he lays his plans accordingly. But at the end of two years, he is told he will get only 12,000 or 8,000, and at the end of three years he is told that the length of his contract has been reduced to six years. By this time his plans are completely ruined.

All this hardly makes for good business relationships. Conditions like these are not likely to encourage a company to make any great effort toward conserving or perpetuating the forest, nor to establish a permanent industry. Why risk pesos financing industrial undertakings, however sorely needed, if the resource on which they depend cannot be protected? I know of one company that of its own volition took over an area of grassland, planted it to trees, and established a flourishing plantation. They carried it along for about thirty years, then the word was given to settlers: "Go in and occupy," and in twenty-four hours the work of thirty years was wiped out.

A number of years ago, another company began reforesting. They wanted to stay in business. Conditions for growth were favorable, so they spent funds and labor establishing plantations. Suddenly, the land was opened for agriculture, the plantations of young trees were cut and burned, the land briefly cultivated and later abandoned. That company is now buying logs and can see the end of its operation in sight. When it does go out of existence about twelve thousand people who for years have depended directly on the forest for a living will be looking for a livelihood. But what a different story it could have been! A permanent industry providing thousands of jobs. A permanent community and hectares of thrifty trees adding to the national wealth instead of a played out, desolate, abandoned countryside.

The Bureau of Forestry

Meanwhile, what is happening to the Bureau of Forestry, the group entrusted by the government with the gigantic task of protecting, administering, and improving the forest resource, a resource, remember, valued at over 25 billion pesos, four times more than the value of all other resources put together? Well, I think the Bureau of Forestry could be best described as undermanned, underpaid, unsupported at top levels, opposed and threatened at local levels, and frustrated in its attempts to carry out its allotted tasks.

Under existing conditions, I can not see that the Forestry Bureau has the slightest chance of fulfilling its obligations to the forests, the forest industry, or the Filipino people. The foresters lack essential equipment. In most cases they depend on concessionaires for transportation; even—at least in one case—for the very paint they use to mark the trees. Small wonder then that trained men are not entering the Bureau at a rate to compensate for the numbers that are leaving. Yet here, if anywhere, is a crying need for competent, trained men, adequately equipped and decently supported. Any program of forestry may succeed or fail depending on the technical competence of the men who carry out that program. No matter how carefully the forest policy of a country may be written, no matter how complete the forest laws, all these will avail very little unless they are administered by a body of foresters well trained technically and imbued with a sense of professional integrity.

And with the invasion of squatters on an ever larger scale, with constant removal of forest land for agricultural purposes, forest management becomes impossible. At present there is not the least assurance that the forest under management today may not be released for agriculture tomorrow. Here, in the instability of the forest and in the impossibility of any rational management, is the very essence of the Philippine forest problem.

The Bureau has initiated a selective system of cutting which entails leaving a certain number of trees to form the nucleus of a new crop so that another cutting may be made again in thirty or forty years on that same area, and may be repeated again and again. It is a good system, for if well applied, the land will always bear trees and be a source of perpetual revenue. The lumber companies are cooperating in this system although it means some financial sacrifice. But what happens as soon as the cut is finished? Squatters swarm in and destroy the remaining forest. The work of the Bureau in marking the trees, the values left by the lumber company are all wiped out, and a young, thrifty forest has been destroyed. That is a high cost for

[3]Timber concessions. Logging on the public forests of the Philippines is performed wholly by private enterprise under timber-extraction permits or concessions issued by the Bureau of Forestry. Concessions vary in size from about 1,000 to 250,000 hectares, and are limited in duration to periods of one to two years, after which they may be renewed "if performance is satisfactory." The government imposes a fixed charge on all timber, regardless of its accessibility.

two or three meager corn crops.

Finally, appropriations for the work of the Bureau are pitifully inadequate. Succeeding Congresses have been very willing to finance Bureau activities that contribute directly to revenue, but little or nothing to activities that go to perpetuate the source of that revenue. Thus, funds have been willingly granted for scaling logs, inspecting and grading export timber; but woefully meager amounts for forest management or for reforesting denuded watersheds; and practically nothing for protection against squatters. Actually that amounts to saying in the plainest possible language, "We are interested in today's revenue from the forest; we're not in the least interested in perpetuating the forest."

Yet your Supreme Court has ruled that "forests and other natural resources constitute the exclusive heritage of the Filipino people." Certainly the Supreme Court could not have meant only the people alive today. What of the Filipinos of tomorrow and the day after tomorrow—your own sons and daughters—what are they to think of a stewardship that deprived them of a heritage that could so easily have been theirs? How are they going to feel at being forced to take over and rehabilitate a wrecked environment just because we of today were only interested in the pesos we could squeeze out of it—no matter what the cost? The old Biblical saying about the sins of the fathers being visited on the third and fourth generation could come true with a vengeance.

Now, one hears much about the pressure of population on the land as the cause of all this. Undoubtedly there is pressure, but I have not been so much impressed with that as I have been with the quantities of unused agricultural land. Not abandoned forest land, but land capable of raising permanent crops. Much of it is still unused or only partially used. I believe more intensive, more efficient agricultural practices would go much further toward increasing the food supply than stripping steep slopes of valuable forest growth. One wasteful process, yet a very usual one, is the farmer's clearing and burning ten or twelve hectares, then poking around the area looking for good soil and possibly finding one or two hectares, while the other nine or ten are left idle.

Popular Misconceptions

Now, I think part of the difficulty—how much I do not know—but part of the difficulty arises from two popular misconceptions. The first misconception lies in the belief that forests are a hindrance, an obstacle to agriculture, a burden on the land that should speedily be got rid of. Most nations go through this period, and where forests are occupying needed agricultural soil, this is entirely justified. The trouble comes when forests are removed from non-agricultural land and the soils begin to deteriorate. Erosion sets in; floods, silt, and drought follow; and life throughout the entire region is degraded to a subhuman struggle for bare existence.

I am thinking now of parts of India where the forests have been cut off for miles around. There is absolutely no fuelwood, and indoor heating is unknown.

Until I had seen India, it had never occurred to me how much time and human activity can be wasted when forests are not available. But there it came to me very forcibly how profoundly human effectiveness, as well as human health and human happiness are involved. Every man who spends a day bringing in a load of fuelwood has lost out of his life one precious day. He has contributed nothing to the world except one load of wood, which could have been got in half an hour if forests had been close at hand.

But the absence of forests had further effects. With wood so scarce, the Indians burned cattle dung to cook their food; and each evening you could see a dense pall of smoke over the little villages, and you knew that thousands of pounds of potential manure were being burnt, instead of returning the rich fertilizer to the earth. The result is an ever-increasing impoverishment of the soil, and poorer agricultural yields. The absence of trees had another bad effect, for the earth lay bare and dry for miles, and when the wind blew, the dust was often so heavy you could scarcely see. You lived in a world of dust; it covered your food and crept into your lungs. And because India is a very old country, it was a highly infectious dust, so that few of us escaped inflamed eyes and throats during the weeks we spent there.

The discomfort and dangers of infectious dust are well known in Mexico. In the City of Mexico even at midday if the wind is up you may have to turn on the lights of your car, for dust storms are swirling across the city, blown from nearby lake beds once filled with water but now dry as any desert because of forest destruction. Those vanished lakes, instead of being a source of water so bitterly needed by the farmer and by the great city itself, today are a source of discomfort and disease.

In the early days of my own country, thousands of acres were stripped of forests. Then we noticed our discolored streams and increased floods, dams filling with silt. Today we are spending millions of dollars to buy some of those forest lands back and we are spending additional millions to repair the damage done, in order to protect our streams, our reservoirs, our dams and agricultural lands.

This concept of the forests as something to be burned and got rid of exists here in the Philippines very strongly, and worse than that, it has been industrialized. It is being used methodically by individuals and groups interested in gaining possesion of land.

The second misconception has to do with the general attitude as to what constitutes agricultural land. Apparently, any patch of earth that will grow one or two poor crops of corn is considered agricultural. But all that has made those two or three crops possible is the stored-up fertility laid down by

years of forest cover. Here in the tropics it is very easy to make the error of believing that any soil which can produce luxuriant forests, such as your magnificent rain forests, must necessarily be of surpassing fertility; but actually much of this soil is not fertile at all. The fertility that sustains these great forests may lie not in the soil but in the vegetation that covers it. The soil is often little more than a foothold for roots and a passageway for nutrients. The fertility comes from the decomposition of dead plants, leaves, and forest litter. Take away the dead and decaying plants as you do when you clear the land for agriculture, and in a very short while you have only a very sterile, inhospitable soil unfit for food crops. Soils, especially tropical soils, are very fragile, easily ruined if bared to sun, wind, and rain.

But here there seems to be a belief that you can create agricultural land by legislation. And of course you may call almost any hectare of forested land agricultural, and release it and raise a few dwindling harvests. Then one of several things will happen. It will be abandoned and may, with luck, return to trees. But more likely it will be taken over by cogon. This may be burned for a few years for pasture until the grass becomes too sparse. By now the soil itself has been killed. If those hectares happen to be on steep slopes, they may begin a destructive cycle of erosion, menacing the agricultural lands below, silting up dams and reservoirs—in a word, making the region less habitable for human beings.

Now in all this, I certainly do not want to seem unsympathetic to making use of every hectare of agricultural land for food crops, provided they are suitable for permanent agriculture. I share wholeheartedly our common interest in increasing food production; but I see little hope in that direction from the present policy of encouraging squatters to destroy a great national resource. Nor is there any conflict between forestry and agriculture. They are not competitive. In fact, forests are the great ally of agriculture in regions where the stabilization of upland soils is necessary to prevent the loss of agricultural land by erosion and flood.

One of the great tragedies of Mexico lies in the fact that tree cutting in the high upland forests has led to floods and erosion that bring down silt and cover the croplands of the valley. So that each year Mexico has 600 thousand more mouths to feed and less and less agricultural land to grow food on.

Throughout the world and throughout the centuries, attempts to establish and grow crops on forest lands have always ended in disaster; disaster to forests, to the crops, and to the soil itself. It has been one of the costliest errors man has ever made.

My own belief is that the legitimate landless Filipino, sincerely looking for a place to make a home is being rapidly replaced by professional squatters, frequently organized by someone higher up. The present pattern seems to be squat, burn the forest, plant a crop, sell the land, move on, and squat again. If these lands, when cleared, were suited for permanent agriculture and could contribute to the public welfare, there would be some justification. But most are not.

The result is that here in the Philippines we are witnessing a land grab that could go down as one of the most notorious in history—a nation being robbed of the very thing that makes existence possible: the soil and the productivity of the soil. "Land for the Landless," which originally was a great humane principle, may soon become "Land for the Lawless."

A Search for Solutions

In the face of all this, what is to be done, or better, what can we reasonably hope can be done within the existing political, economic, and social framework? Of one thing I am sure. The overwhelming factor is the invasion of forested land by kaingineros and the failure of government to deal with this gigantic loss. It is this situation that dominates the whole picture. Fundamental to any solution of the forest problem, then, is the enunciation of a rational land policy that would proclaim the areas of permanent forest land that the nation requires and protect those areas inviolate from all trespass. Unless this stability and protection are given, all other measures scarcely matter. It is like treating a patient for dandruff who is slowly but steadily bleeding to death.

But proclaiming permanent forest is not enough. Once proclaimed, it must be protected from squatters, from theft, and from trespass. That means implementation and enforcement. For laws alone do not protect forests. There must be the will and the machinery to translate law into action. Without this, it is far better to pass no law at all. For forest laws that are not enforced breed contempt for all laws and are destructive to the very foundations of government.

Second to stabilizing the forests, there is an urgent need to provide greater stabilization to the lumber industry and greater security of tenure. I believe this could be done by giving long-term leases and a guaranteed amount of timber, so that a company can feel reasonably justified in making the financial outlay necessary to efficient operation. I believe too it should be given the authority and the responsibility for protecting the lands under each lease. Today, the concessionaire cannot protect himself from trespass because the land is government land; but if the lessee himself were given the responsibility for protecting the timber as part of the contract, he could deal much more effectively with the squatters. I think too that if local governments could realize a certain percentage of the money received for timber cutting as well as fines collected from forest violations, it would be a very practical incentive to cooperate in the fight against the squatter. The United States has adopted this policy with proper safeguards, and it has worked well in winning the interest of local governments in the

value of permanent forests and changing their attitudes toward forest destruction.

Third, I believe there is urgent need to build up the Bureau of Forestry in order to make possible its proper function and to give it the dignity and authority and competence that should be given a body of men in whose hands has been placed the welfare of your greatest renewable natural resource.

Now, I would be omitting one very pertinent factor if I failed to mention the need for a campaign of public education that would carry the lesson of the value of forests to economic and human welfare. For beyond the steps that I have already talked about lies an immense need for education. This includes the many forms of conservation information for adults, especially the lawmaker, and the inclusion of resource teaching in the schools.

One thing is certain—until a far greater portion of the Filipino people is made to realize their dependence on the land and its resources, little permanent progress can be hoped for. To change public attitudes toward the abuse of land and forests is the only final solution. It cannot be effected by legislation alone. It must come as a result of education. In saying this, I realize all that is involved here: the long, tedious process of education, the need for new attitudes on the part of government if any program of conservation is not to remain a dead letter in official archives but is to be translated into action out on the nation's burned and abandoned hectares. For in a very literal sense the Philippines are engaged in a race between education and disaster. And however difficult the task, there must be created a national will; and you cannot create that until the people realize the importance and the extent of the problem and can relate it to their own way of life.

Legislation must come first—legislation and enforcement — for we cannot wait for the long-term process of education; and, of course, enforcement in itself is a kind of education. So I would say that legislation will be needed, plus enforcement, plus a rational land use policy, plus better conditions for the lumber industry, plus the building up of the Forestry Bureau to a point where it can redeem its responsibility as the protector and administrator of the people's forests.

I do not believe that the forests of the Philippines are going to be obliterated. There are still large areas of forest remaining. How large they are, and how much timber they contain are matters of dispute. But the exact extent of forests today is not nearly as important as the fact that they are being destroyed at an ever-increasing rate, that they are being misused in such a way that they cannot reproduce themselves. So long as those conditions continue, no matter how much forest you have it is only a matter of time when the end will be in sight; and whether it is 20 or 200 years, the impact whenever it does come will be just as devastating to human life in the Philippines. There is nothing in the scheme of things to prevent the same fate that has happened on Cebu and parts of Negros from happening anywhere else in the islands. I still do not believe that will happen, for I have met enough forward-looking individuals and groups like this who are fully aware of the problem, and I have met members of the press who are already doing a stupendous service in keeping this problem before the people. And all this makes me believe that some day a halt will be called to this destruction.

But the question is, when? For time is of the essence. Every year's delay makes the task of rehabilitation more costly and less rewarding. Delay itself becomes a kind of failure and there is no need to fail —you have the forests, you have men in the lumber industry eager to perpetuate the source of their livelihood, you have trained men in your Forestry Bureau. Your forests can add immeasurably to the national wealth if they are protected and not wrecked. But this decision whether to wreck or protect—like all great national decisions—must lie with the Philippine Government and the Filipino people.

My earnest prayer is that the decision will have the courage and wisdom worthy of a great people —and that it will come soon.

The Oregon Forest Lands Research Center

Dale N. Bever

In the August 1958 issue of the JOURNAL, *an issue devoted to wood products, there appeared an article by John B. Grantham on the Oregon Forest Products Research Center. The present article is written to complement the previous one and to give an account of the activities of the Oregon Forest Lands Research Center. Research in both forest lands and forest products is conducted at the new Oregon Forest Research Center in Corvallis.*

PASSAGE of the Oregon timber harvest tax in 1947 to finance a forest research program brought about the expansion of forest products research and the creation of a forest lands research program. A tax of five cents was levied on each thousand board feet of timber harvested, with certain annual exemptions. Sixty percent of this revenue was for forest products and 40 percent for forest lands research. The new program dealt with research and experimentation for the protection, rehabilitation, and management of forest lands.

Considerable progress was made from 1947 to 1953, when legislative changes were to affect greatly the status of the forest lands research program. In the 1953 legislative session, the tax supporting research was reduced to four cents per thousand board feet of timber harvested. During the same session the Forest Protection and Conservation Committee was created to supervise and control forest lands and products research activities.

The Forest Protection and Conservation Committee achieved program control at the outset by contracting with the Oregon State Forestry Department. The department had a going program, office facilities, and the means of providing the necessary administrative services. All research personnel were department civil service employees.

From 1953 to 1956 the forest lands program and staff continued to expand. Some of the personnel embarked upon graduate programs at Oregon State College to better qualify themselves in their positions; new personnel with specialized training were added to the staff.

By 1956, the Forest Products Laboratory, which had always been on the Oregon State College campus, was having housing difficulties. The college was expanding; the space occupied by the laboratory was needed for educational purposes. After studying the situation and reviewing it with all concerned, the Forest Protection and Conservation Committee in March 1956 authorized consolidation of the forest lands and products research programs. These two important activities are now housed in a modern all-wood research plant containing 40,000 square feet of office and laboratory space.

Under the consolidated organization the Forest Protection and Conservation Committee supervises research activities and controls expenditures through its Administrator, who has offices at the Forest Research Center.

Today's Oregon Forest Lands Research Center

Physical facilities.—The new home of forest lands research, near the Oregon State College campus, certainly, as Mr. Grantham stated, "... exemplifies the beauty, economy, and utility of modern wood construction." The building is very functional. It not only provides individual office space for each technical staff member, but also has considerable laboratory space for the varied activities of the research program. The laboratory area devoted to forest lands research is divided into pathology, plant physiology, genetics, entomology, and mammalogy laboratories, a large walk-in cold room, and a large open work area. Soon to be completed adjacent to the new building will be a five unit greenhouse and plant growth building, an insectary, and a mammal building. The remainder of the forest lands research activities are scattered, as would be expected, throughout the forested areas of Oregon. A fleet of 12 vehicles takes the staff into the field where a majority of the research is accomplished.

Technical Staff

The technical staff of 13 includes a director, an associate director, and 11 specialists in various fields of forest research. Trained specialists are available in forest management, plant physiology, forest pathology, meteorology, genetics, mammalogy, forest entomology, and forest ecology. A forest soils position is at present authorized, but has not been filled.

The unique feature of this staff is that it is organized on research rather than administrative lines. There are no sections, sub-sections, departments, or divisions headed by chiefs. Every man has equal standing on the staff and may work his way up the promotional ladder on merit alone. It is quite possible for a man to start at the bottom of the ladder and be promoted to

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the top (with salary equal to the associate director) without changing jobs or assuming any additional duties of an administrative or supervisory nature. In this manner good research men can continue to do research and need not be promoted out of research into supervisory positions just to give them the salary and recognition they deserve.

Program Guidance

In addition to the Forest Protection and Conservation Committee, which has direct control over the program, the Center has an Advisory Committee composed of representatives from private, state, and federal forestry agencies who give advice, review the program, and actually voice formal approval or disapproval of each major undertaking.

Scope of Forest Lands Research

The early program of lands research, in 1947, started with work in natural regeneration, direct seeding, second growth management, forest protection, and tree planting. Today the program has expanded to embrace nine major fields of study:

1. Forest tree seed studies, covering seed production, dissemination, collection, extraction, cleaning, storage, and germination.

2. Forest tree seedling studies, including seedling production, establishment, and survival.

3. Forest tree studies, encompassing growth and development, quality, intermediate cuttings, and harvest cuttings.

4. Forest fire studies, including climatology, fire danger, fuels, and fire behavior.

5. Forest insect studies, covering forest insects injurious to all age classes of trees and to forest products.

6. Forest disease studies, concerning diseases affecting seedlings, young stands, mature stands, and forest products.

7. Forest mammal studies of those animals detrimental to the establishment and growth of forest trees.

8. Forest soils studies, embracing soil-growth relationships and the mechanical properties of soils.

9. Forest genetics studies, involving the characteristics of reproduction, survival, yield, quality, and resistance to insects, diseases, or animals. Studies are also undertaken relative to distribution of races, genotypic variation, inter species crosses, intra species crosses, and methods of inheritance of "marker" characteristics.

A few examples of current projects will serve to illustrate the type of work undertaken.

One of Oregon's present problems in forestry in that of securing prompt and adequate regeneration on hot, dry, south exposures. The plant physiologist and the geneticist are working together to determine the nature of drought and heat resistance in Douglas-fir seedlings and to develop drought resistant planting stock.

The Douglas-fir beetle, one of Oregon's major forest insect pests, is being studied jointly by the entomologist and the pathologist to determine the relationship of fungi to the success of Douglas-fir beetle attacks.

In the second growth management studies, the forest management specialists not only study the silvicultural and economic significance of intermediate cuttings but also have the assistance of others on the staff to determine effects of such thinnings on stand nutrition, disease problems, insect problems, and other related issues.

The meteorologist in studying fire behavior problems is joined by the pathologist to determine the effect of fire on soil organisms.

Cooperative Research

The Oregon Forest Lands Research Center engages in cooperative research with many private companies and many state and federal agencies. The number of current cooperators is so great that it would be impractical to list them here.

A typical example of a cooperative project is the Douglas-fir provenance study. In this study private, state and federal agencies are giving their full support in the establishment of plantations stretching from northern Vancouver Island in British Columbia to Jackson County in southern Oregon.

Distribution of Research Findings

A continuous flow of visitors to the Center and a considerable amount of correspondence serve as methods of dissemination of research findings. In addition to the many printed outlets for research results such as trade, professional, and scientific journals, the Center issues a series of research bulletins and research notes. There is no charge for publications; they are available on request as long as supplies last.

As a further method of interchange of research findings, and to keep abreast of current developments in the scientific field, the members of the staff are expected to belong to, attend, and participate in regional and national science and professional organizations.

Oregon, the first state to initiate a forest industry and state-supported program of research, is proud of its Forest Research Center. The Center, in a state where some 60 percent of the income is derived from forestry and forest products, is aware of its responsibilities and the opportunities to serve its major industry and is endeavoring to meet the challenge.

Observations on Root Systems of Planted Loblolly Pine

George F. Gruschow

A 3-YEAR-OLD plantation of loblolly pine with 4-foot trees dominating the area is a very attractive sight, and one that brings a feeling of well-being and accomplishment to the forest manager responsible for planting the stand. That such complacency, based on the appearance of planted trees at this early age, might be premature and unwarranted is indicated by the findings of a survey of planted areas in southeastern Virginia made in the spring of 1958. It was found that 67 percent of the trees had malformed root systems caused by poor planting.

As part of a study to relate forest plantation success at the end of the third growing season to ground preparation methods, degree of hardwood control, and site index, root systems of a number of seedlings were examined. Tracts totaling 4,729 acres were available for the study. They were in several ownerships and had been planted in the 1954-1955 season. All of the plantings were made on cutover or otherwise forested land, and none had been established on old-field or abandoned agricultural land. Some of the areas had been subject to mechanical site preparation, such as bulldozing or disking, prior to planting; others were simply logged with no additional site preparation. The residual hardwoods were eliminated to release the seedling pines on some of the tracts; on others this was not done. In all cases the planting was accomplished by the use of a planting bar. No machine-planted areas were sampled.

In the course of the study, 41 field observation plots were established. Each plot consisted of a series of 100 milacres uniformly spaced over 1.25 acres of plantation. On each milacre all loblolly seedlings were examined to determine if they were of natural origin or planted. We found that under the conditions of the study it was impossible to determine whether or not seedlings of this age were planted or of natural origin without digging the seedling and examining the roots. Because the trees were bar-planted, the compressed root system was *prima facie* evidence of planting. This characteristic was very distinct (Fig. 1).

As the planning of the study progressed and some preliminary examinations of plantations were made, it was evident that a great number of the planted seedlings had malformed or poorly formed roots. A rough classification of root system was formulated and the planted seedlings were separated into the following classes, based on the nature of the roots (Fig. 2):

1. Good roots—those seedlings which had a distinct taproot developing downward.

2. J-roots—those seedlings which had the taproots bent upward.

3. L-roots—those seedlings in

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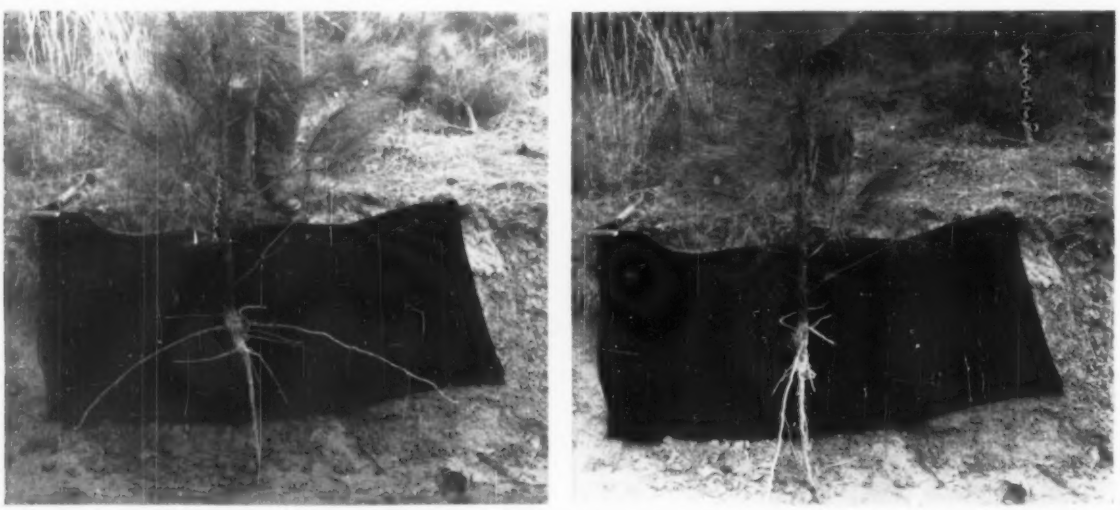

FIG. 1.—*Left*, a typical root system on a bar-planted 4-year-old loblolly pine seedling. *Right*, the same seedling, rotated 90 degrees. Note compression of root system caused by bar-planting.

which the taproots were bent horizontally and were developed somewhat at right angles to the direction of a normal taproot.

4. Balled-roots—those seedlings in which the taproots were so deformed or cramped that they defied classification into any other categories.

In all of these root systems the flattening of the developing roots into a more or less restricted vertical plane, which is characteristic of bar-planted seedlings, was apparent.

A total of 2,005 planted seedlings and a greater number of naturally established seedlings were dug up and the roots of the planted trees were classified as follows:

Root class	*Number*	*Percent*
Good roots	662	33
J-roots	702	35
L-roots	220	11
Balled roots	421	21
	2,005	100

The consistency of the subsoil on the planting site was classified as friable, plastic, or semi-plastic. The proportion of seedlings by classes did not vary by soil characteristics, site preparation, or ownership.

Generally, as can be seen from Figure 2, it was impossible to predict the condition of the roots from the above-ground development and appearance of the seedlings. The early growth of the young trees did not seem to be related to the root classes. An exception to this might be balled roots without much lateral bracing (Fig 2, lower). In these cases a heavy load of snow or ice, or the pressure of high wind would overturn the tree.

Many seedlings we dug up had been planted deep; that is, the soil line at the planting site was well up the stem from the root collar or soil line of the seedlings as it had developed in the nursery bed. This condition shows clearly on the seedling with the balled root (Fig. 2). When seedlings were deeply planted in low areas where the water table was near the surface for a long part of the growing season, very little growth occurred; some seedlings were found in wet

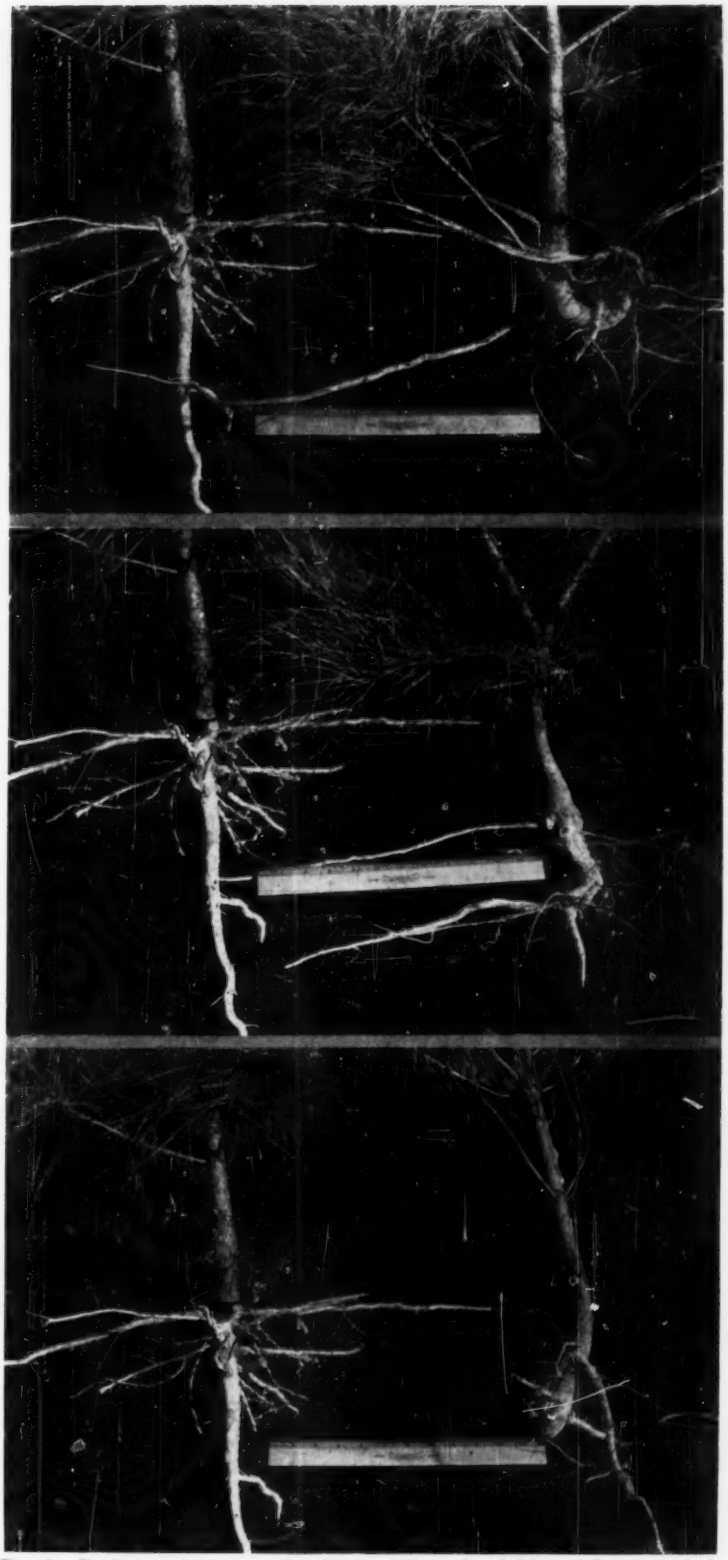

FIG. 2.—Typical root systems of natural seedlings (on left) and bar-planted (on right); *Top*, J-shaped; *center*, L-shaped; *bottom*, balled roots.

spots just about the same size as when planted 3 years earlier. Other deep-planted seedlings upon better aerated seedbeds had developed well and grown normally. It was consistently evident that, after 3 growing seasons, no roots had developed above the root collar of the seedling and that the underground portion of the young planted tree above the root collar resembled stem more than root.

There has been considerable discussion and speculation in the literature of possible detrimental effects of the initial placement or cramping of tree roots during planting. However, this question is as yet unresolved in this country because there are so few plantations of rotation age where the effect of planting can be determined accurately. Rudolf[1] cites studies in Russia and Sweden where slit-planted trees that appeared perfectly healthy showed sudden losses when the crowns closed and competition became keen. The losses were attributed chiefly to deficient root development as a result of the method of planting. The same author also states that excavation of 5,000 bar-planted pine in the Lake States (jack and red pine up to 13 years old) showed that the root systems of 65 percent of the trees were formed into a single plane and that survival was reduced 20 to 30 percent and their growth about 20 percent. There was some indication that jack pine showed better ability to overcome such root deformity than did red pine. On the other hand, Wakeley[2] states: "Apprehension concerning adverse effects of slit-planting on later survival and growth seem unwarranted so far as bar-planted southern pines are concerned. Excavating of roots, and the evident vigor and thrift of thousands of acres of plantations already yielding pulpwood and naval stores argue against any great lurking danger from bar-planting these species."

There is much greater agreement on the detrimental effect of planting trees with roots distorted. Toumey and Korstian[3] state: "One of the most frequent defects in planting arises from crowding trees with large roots into shallow holes." In many cases observed during the present study the planting hole was large enough but the planting technique was careless. This carelessness caused roots to recurve and wad and gave the same end result, that of an unsatisfactorily planted seedling.

Planted trees are subject to the same hazards of weather, disease, insects, fire, and other injurious agencies as are naturally established trees. In addition there are increasing indications that plantations are heir to perils not present in forest grown stands. Baxter[4] reports that "trees (pines at least) established by natural seeding seem far less susceptible to invasion by fungi and bacteria than planted trees." It would seem logical to assume that malformed and strangled roots caused by poor planting techniques could serve as an avenue of infection. Rotten roots were noted on several of the excavated seedlings classified as having J- or balled-root systems.

Under the pressure of the present large-scale planting programs, the on-the-ground supervision given the planting crews may not be as effective as it was in the earlier days of reforestation. From our studies it appears that of the 3-year-old plantations sampled, covering over 4.5 thousand acres and in several ownerships, only about a third of the planted seedlings had what appeared to be normally developed root systems. This finding indicates that greater care should be given to the correct planting of seedlings.

[1]Rudolf, P. O. Forest plantings in the Lake States. U. S. Dept. Agric. Tech. Bul. 1010, 171 pp. Illus. 1950.

[2]Wakeley, P. W. Planting the southern pines. U. S. Dept. Agric. Monog. 18. 233 pp. Illus. 1954.

[3]Toumey, J. W., and C. F. Korstian. Seeding and planting in the practice of forestry. Ed. 3, 520 pp. Illus. New York. 1942.

[4]Baxter, D. V. Pathology in forest practice. 618 pp. Illus. New York. 1943.

Surveys of Douglas-Fir Cone and Seed Insect Damage in Northwestern California, 1954-1958

Robert E. Stevens

SINCE 1946 logging in northwestern California has experienced a marked upswing. Sawlog production in Humboldt, Del Norte, Siskiyou, Trinity, and Mendocino Counties increased from 343 million board-feet to 2,040 million board-feet in 1956 (*4*). Most of this volume is in redwood (*Sequoia sempervirens* [D. Don] Endl.) and Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco). Douglas-fir—seldom logged here before World War II—has received increasing attention for management for sustained production. During the early part of the period, regeneration failures were often observed. By 1952 this problem was conceded to be critical, and in that year the California (now Pacific Southwest) Forest and Range Experiment Station began research on Douglas-fir regeneration. This work and the results of forest pest surveys indicate that cone and seed insects are a serious deterrent to sustained production.

Though the regeneration studies, conducted by D.F. Roy of the Station's division of forest management research, are not yet complete, recent summaries of the data show that prompt natural regeneration is essential (*7*, p. 17).

Because of rapidly developing competition from brush and herbaceous plants, reproduction has to become established on a cutover area within 3 years after logging in order to regenerate the stand. Good cone crops in California's Douglas-fir region are irregular, and some crops that appear to be satisfactory early in the year fail to produce an adequate amount of seed because the crop is largely destroyed by insects. Several other problems are involved in obtaining natural regeneration, but insects are of prime importance since they usually have the "first crack" at the seed crop.

Because of the uncertainties connected with natural regeneration, land managers are beginning to depend more and more on planting to renew the stand. This is causing an increase in the demand for seedlings and consequently for more seed. Again, insects enter the scene—their impact on seed-collecting programs has been felt strongly, particularly in 1958, and this facet of the problem is one that will be more important as planting programs continue to expand.

Insects Causing the Damage

Keen (*3*) lists 17 species of destructive insects that have been reared from Douglas-fir cones and seeds, but only a few of these are generally important. They are: the Douglas-fir cone moth, *Barbara colfaxiana* (Kearf.), the fir coneworm, *Dioryctria abietella* (D. & S.), and the Douglas-fir seed chalcid, *Megastigmus spermotrophus* Wachtl. Recently gall midges, probably *Contarinia oregonensis* Foote, have been found to be responsible for a significant amount of damage. The relative importance of each of the species varies considerably from place to place and from year to year.

These insects cause damage in several different ways. Both *Barbara* and *Dioryctria* are moths, and their destructive stages are the larvae. These larvae mine indiscriminately throughout the cone, destroying scales and seeds alike. They thus dwarf and deform the cone (Fig. 1) and eat some seeds. A single larva of the Douglas-fir cone moth in a cone has been found to destroy about 45 percent of the seed (*5*). Multiple infestations by

FIG. 1.—Normal Douglas-fir cones (top) and dwarfed cones infested with the Douglas-fir cone moth. X½

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FIG. 2.—Douglas-fir seed chalcid adult female. (Approximately 3 mm in length).

cone moths—that is, more than a single larva per cone—are common, and oftentimes heavily infested cones produce no seed whatsoever.

The Douglas-fir seed chalcid, (Fig. 2) a tiny wasp, lays its eggs through the cone scales into the seeds, one per seed. The developing larva feeds on the embryo and endosperm, completely hollowing the seed.

Gall midges form tiny swellings on the cone scale, which commonly cause the seed to remain in the cone rather than fall normally. When midge population levels are high, they may completely displace and destroy all the seeds in a cone (*2*).

Damage Surveys

A survey of the amount and character of Douglas-fir cone and seed insect damage in northwestern California was started in 1954. It has been carried out each year since then, and survey reports were issued in 1955 and 1957 (*1, 6*). Figure 3 shows most of the sample locations—the stations omitted are off the boundaries of the map.

Cones were collected each season in late August or early September. After the samples were gathered, they were dried and the seed extracted. Each cone was then examined and classified as moth-infested or not moth-infested, by the presence or absence of frass and mines through the cone. No attempts have been made to separate the different species of cone moths, nor have multiple infestations been counted separately.

Samples of apparently good extracted seed were then cut to determine the presence of seed chalcids. In the first survey (*1*), seed alone was sampled, and all hollow seeds were considered to be insect-damaged. Since then these hollow seeds have not been counted as insect-caused because it is now felt that many of them may result from pollination failures. There is a possibility, however, that some of them may be hollow because insect

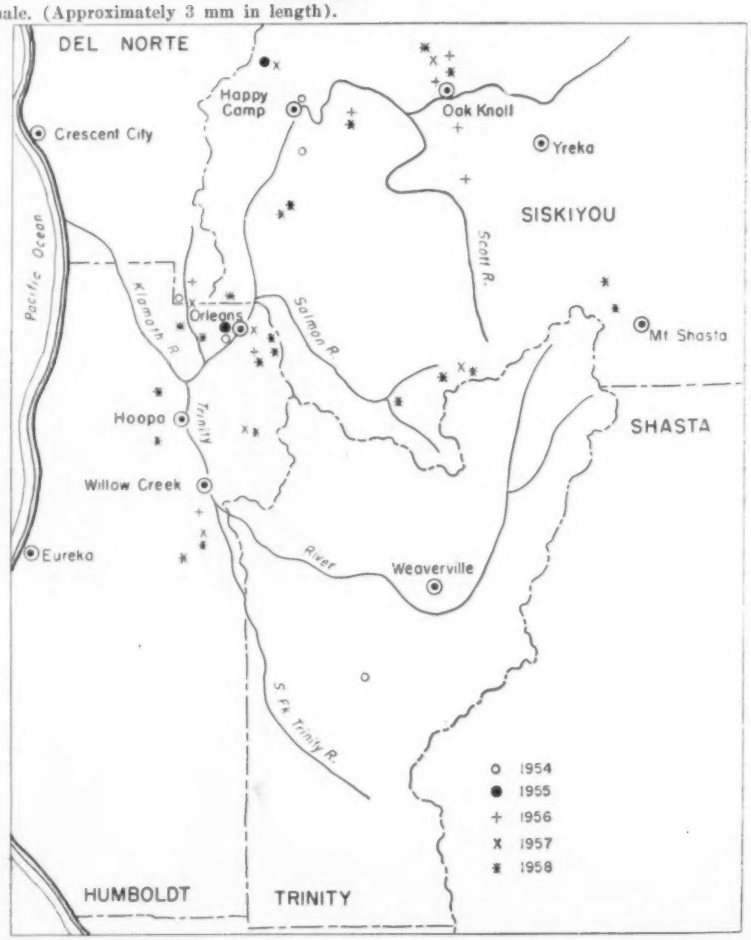

FIG. 3.—Portion of northwestern California showing Douglas-fir cone and seed insect sample locations and years sampled.

feeding interfered with their development.

Loss due to midges has not been sampled. From 1954 throught 1957 it did not appear to be a significant factor, but in 1958 midges did account for a considerable amount of damage.

Findings

Tables 1 and 2 summarize moth and chalcid damage shown by the surveys; part of the information is taken from the already published reports.

In 1956, most trees produced cones; this was the only generally good cone crop in California's Douglas-fir type in the past 7 years. In 1955 the cone crop was extremely light, and in 1957 it was practically zero, the 7 samples being obtained only by dint of considerable searching. The increased number of samples collected in 1958 reflects both an added effort directed toward cone and seed insect study and also a moderately good cone crop.

In 1956 there was enough seed for insects and foresters alike. The percentage of infestation was low, and seed production was extremely high. In 1957 the insects took a larger proportion of the cones, but the damage was of no practical importance because the crop itself was essentially nonexistent.

The 1958 season was in-between in overall cone production. Although losses from cone moths averaged higher than in 1957 and midge damage was more prevalent, cones occurred in enough places that some areas escaped damage to a large degree. From what limited observations have been made, spottiness appears to be characteristic of these infestations; some relatively insect-free areas can probably be found and utilized by seed collectors even in years when the cone crop is only moderate.

There is a possibility that some of these areas are consistently freer from insect activity than others. If investigation should reveal this to be the case, and other factors are favorable, these sites might be considered for permanent seed production areas.

Research on Douglas-fir cone and seed insects is underway in several locations in the western United States and Canada, and control answers will be forthcoming. But until the time when methods can be developed to control the insects when and where desired, California foresters must continue to take maximum advantage of the years and areas in which an adequate amount of sound seed is produced.

TABLE 1.—DAMAGED DOUGLAS-FIR CONES AND SEEDS, COLLECTED CONE SAMPLES, NORTHWESTERN CALIFORNIA, 1954-1958

Year	No. of sample locations	No. of cones sampled	Percent cones moth-infested	Standard error	No. of seed cut	Percent chalcid infested	Standard error
1954	10	---	---		4,916	82.2[1]	±4.7
1955	4	---	---		800	9.9	±6.8
1956	8	400	16.5	±4.9	4,000	0.4	±0.26
1957	7	104	47.3	±8.8	989[2]	6.4	±2.3
1958	21	793	73.3	±5.8	1,077	7.1	±3.5

[1]Includes hollow seed.
[2]From 3 locations only.

TABLE 2.—CHALCID-INFESTED SEED FALLING INTO SEED TRAPS IN DOUGLAS-FIR CLEARCUT BLOCKS, NORTHWESTERN CALIFORNIA, 1954-1957[1]

Year	No. of sample locations	No. of of seed cut	Percent chalcid infested	Standard error
1954	4	8,757	21.0	±6.9
1955	4	1,991	0.7	±0.5
1956	4	22,281	4.5	±2.9
1957	4	2,474	1.0	±0.5

[1]Data furnished by the Division of Forest Management Research, California Forest and Range Experiment Station.

Literature Cited

1. HALL, R. C. 1955. Insect damage to the 1954 crop of Douglas-fir and sugar pine cones and seeds in northern California. U. S. Forest Serv. Calif. Forest and Range Expt. Sta. Misc. Paper 18, 4 pp. (Processed.)
2. JOHNSON, NORMAN E., and H. J. HEIKKENEN. 1958. Damage to the seed of Douglas-fir by the Douglas-fir cone midge. Forest Sci. 4:274-282. Illus.
3. KEEN, F. P. 1958. Cone and seed insects of western forest trees. U. S. Dept. Agric. Tech. Bul. 1169. 168 pp. Illus.
4. MAY, RICHARD H., and HAROLD BAKER. 1958. Output of timber products in California, 1956. U. S. Forest Serv. Calif. Forest and Range Expt. Sta. Forest Survey Release 35, 39 pp. Illus. (Processed.)
5. RADCLIFFE, D. N. 1952. Seed loss due to the Douglas-fir cone moth. Canada Dept. Agric., Sci. Serv. Forest Biol. Div., Bimonthly Prog. Report 8(1): 3.
6. STEVENS, ROBERT E. 1957. Insect-caused damage to the 1956 Douglas-fir cone crop in California. U. S. Forest Serv. Calif. Forest and Range Expt. Sta. Forest Res. Note 120, 2 pp. (Processed.)
7. U. S. FOREST SERVICE, CALIF. FOREST and RANGE EXPT. STA. 1958. Annual report—1957. 82 pp. Illus.

A Precommercial Thinning in Ponderosa and Jeffrey Pine[1]

Dennis E. Teeguarden and Donald T. Gordon

OVERSTOCKED PONDEROSA PINE (*Pinus ponderosa* Laws.) and Jeffrey pine (*P. jeffreyi* Grev. & Balf.) seedling and sapling stands display a marked tendency to stagnate or grow slowly on poor sites. This condition of virtually no growth can persist for many years, and if not corrected could interfere with reaching production goals. If the progression of seedlings and saplings to mature harvestable trees is to be maintained in these stands, early thinning is a silvicultural and management requirement.

However, before undertaking precommercial thinning the forest manager will ask several questions. What will tree response be, for instance, to different thinning methods and spacings? What are the subsequent increases in yields and revenues? One important question will be: If precommercial thinning is added to the management program, what are the additional costs? What is the relationship between thinning costs and such variables as spacing, thinning method, type of equipment, terrain, stand density, and stand composition? Armed with answers to such questions, the forest manager could then compare the additional costs of thinning to the additional revenues obtained in order to determine the profitability of thinning.

Relieving stagnation by means of precommercial thinning in young stands has been undertaken at the Blacks Mountain Experimental Forest in northeastern California. The project began in 1955 and was continued in 1957. Thinning has been applied primarily to sapling stands, both pure pine[2] and pine mixed with white fir (*Abies concolor* [Gord. and Glend.] Lind.) and incense-cedar (*Libocedrus decurrens* Torr.).[3] To date the project has covered a total of 519 acres gross area and has released more than 22,000 trees on 44.8 acres net area.

Earlier studies at Blacks Mountain indicated a positive response of pine saplings to thinning. A 9-foot spacing was selected for general application in thinning sapling stands on the experimental forest. This decision was based partly upon evidence from thinned and natural young growth, and partly upon judgment as to the future development of such stands. Studies in the Northwest (*5*) and Southwest (*2*) obtained similar results.

In brief tests, small portable motor-driven saws showed promise for economical thinning of saplings from about 1 inch to 3 or 4 inches in diameter at stump levels. These tests compared axe thinning to power saw thinning, and indicated costs of 13 cents and 8 cents per tree, respectively.

The objectives of the project reported here were several: (1) to start thinning in overdense stands as a stand improvement measure; (2) to work out practical techniques; (3) to obtain preliminary cost and production data which are related to a 9-foot spacing, a particular method of thinning, and type of equipment, and to stand and ground conditions on the experimental forest. These data would indicate the general level of thinning costs and provide a basis for determining the feasibility of expanding the study into more detailed phases.

The purpose of this paper is threefold: (1) to describe the thinning methods and field procedures used at Blacks Mountain; (2) to present the production and cost data obtained during the two seasons of work; (3) to discuss the significance of the results.

Experimental Area and Young Stands

Located on the east slope of the southernmost tip of the Cascade Range, the Blacks Mountain Experimental Forest is representative of the four million acres in the Eastside Pine type of California's Northeastern Plateau. It has a site index of 72 feet at age 100 years according to the inter-regional ponderosa pine site classification.[4] Low annual precipitation, most of which is snow, is the main limiting factor of tree growth. The soil is stony and shallow, with frequent rock outcrops. About one-half the experimental forest is in a gently rolling basin; the remainder extends up the 10-17 percent slopes of surrounding mountains.

The forest type is predominantly ponderosa pine and Jeffrey pine, but mixtures with white fir and incense-cedar are found on the upper mountain slopes. Seedlings and

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[1]A cooperative project of the California Forest and Range Experiment Station of the Forest Service, U. S. Department of Agriculture and the University of California School of Forestry, Berkeley. The project was planned and field work conducted by the Forest Service; analytical work by the School of Forestry. This report is adapted from a Professional Paper submitted by the senior author to the School of Forestry while he was a graduate assistant there in partial satisfaction of the requirements for the degree of Master of Forestry.

[2]Jeffrey pine in these stands is not differentiated from ponderosa pine in management. Throughout this report the two species are usually referred to collectively as pine.

[3]Technically, the work in some of the mixed stands was a cleaning rather than a thinning.

[4]Meyer, Walter H. Yield of even-aged stands of ponderosa pine. U. S. Dept. of Agric. Tech. Bull. No. 630, 60 pp., Illus. 1938.

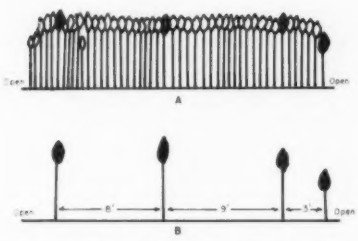

FIG. 1.—(A) Schematic diagram of a transect through a uniform, stagnated ponderosa pine sapling stand. Crown differentiation has not yet occurred, with the typical tree having a narrow, thin crown and a "whip-like" bole. (B) Same stand after thinning. Because of the opening to either side of the stand, marginal trees were left closer than the 9-foot spacing.

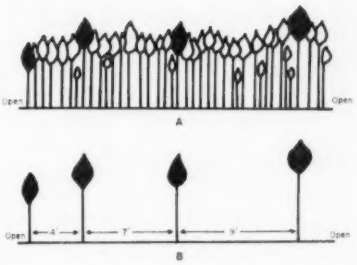

FIG. 2.—(A) In this stand (even-aged) crown classes are apparent, but due to overstocking, diameter and height growth is negligible. (B) The same stand after thinning. By modifying spacing requirements three dominant trees were left in this stand whereas only two would have been left with a fixed spacing.

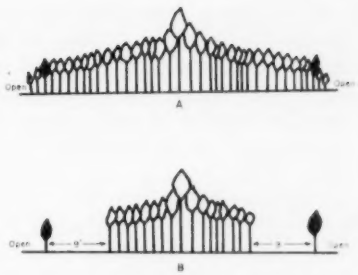

FIG. 3.—(A) An even-aged stand of ponderosa pine saplings which exhibits pyramidal height structure. The dominant tree in the center is making relatively good growth and would not warrant release. (B) The stand after thinning. By giving growing space to peripheral trees more effective use of the site is realized.

saplings are abundant in openings and under mature overstories. In recent years logging in the area has released most of the pole stands and many of the sapling stands.

The occurrence of young trees in small, dense groups is a prevailing habit of pine in this area. These groups are seldom more than half an acre in size and usually are considerably smaller. They tend to be even-aged, with stand ages ranging from 25 to 70 years. Because of suppression or stagnation, or both, diameters and heights in most stands are below normal for their age. Although the average density is much lower, some sapling stands are as dense as 17,000 trees per acre and exhibit the characteristics of the so called "pine thicket" (Fig. 4). Trees only 2 inches in diameter at ground level and 9 feet in height at 70 years of age are not uncommon.

Method of Thinning

One general type of thinning was employed. It was a compromise between low thinning of a heavy grade (D)[5] and mechanical spacing, and was aimed at releasing well-formed, dominant trees from competition at an average spacing of 9 feet. The major variations are shown schematically in Figures 1, 2, and 3. A representation of the appearance before and after is illustrated in Figure 4. Thinning to 9x9 feet was decided upon before the start of the study. It was selected because it will provide space for rapid growth, make an allowance for future mortality, and provide for a fully stocked stand at the time when intermediate cutting will be feasible.

In practice, both spacing and the type of trees released varied. This provision for flexibility allowed selection and retention of a greater number of better quality trees than would have been the case had a 9-foot spacing been rigidly applied and had only dominant trees been released. In stands surrounded by open ground, trees on the edge of the stand were left closer together than 9 feet because of the growing space. The ratio of trees released to trees cut varied from about 1:2 to 1:7 on the different compartments and averaged about 1:5.

[5]Hawley, Ralph C. The practice of silviculture. Third ed. 340 pp., illus. Wiley & Sons, New York. 1935.

FIG. 4.—*Left*, A 55-year old ponderosa pine sapling stand on the Blacks Mountain Experimental Forest before thinning. Stand density is about 17,000 trees per acre. Note the rather flat, "bushy" tops of the trees in the foreground, which is indicative of the poor growth being made under the condition of heavy competition. *Right*, The same stand after thinning to a spacing which averaged 9½x9½ feet. Stand density is now about 500 trees per acre.

Generally, no trees were released if they were within 30 feet of a mature tree or within 20 feet of a large pole.[6] In sapling stands bordered by a group of small poles, no trees were released within 10 feet of the poles.

Dwarf mistletoe control work was accomplished in conjunction with the thinning treatment. The procedure followed was to remove all infected trees and then choose reserve trees from those remaining. Some infected trees, however, were left in heavily infected stands if the infection was low in the crown, if it was more than 6 inches from the bole, and if the tree was otherwise especially desirable as a crop tree. To a very limited extent, infected limbs easily reached with the saw were pruned out.

Slash created by thinning was left where it fell. Although heavy accumulations in the densest stands would probably increase fire danger, areas of continuous slash from thinning were not extensive and were scattered enough that the hazard was not considered excessive. At worst, the existing hazard is short-lived, as this type of slash disintegrates rapidly even in a dry climate. In regard to fire control, if a fire line must go through the stand, the rate of building fire line would be faster in the thinned than in the unthinned stands, thus partially offsetting the disadvantage of the presence of slash.

Field Procedures and Equipment

Because of the scattered distribution of thinnable groups, it was impractical to operate over entire management units 80 to 100 acres in size without providing a means for systematic coverage of the area. Accordingly, compartments selected for thinning were subdivided into strips 2 chains wide by means of string lines laid out by hand compass. This arrangement allowed a complete and systematic coverage of large areas. Also, a minimum of lost time was incurred each day in finding the place where work ceased the preceding day, and in relocating equipment, gas cans, and tools left behind as the work progressed. Strips were given numbers, thus providing a means of checking work, reporting progress, and assigning crew members to a specific area. On the steeper slopes, lanes were laid out roughly parallel to contour lines to avoid working up and down grade; where slope was not a controlling factor, lanes were at right angles to the access road. This provided a convenient way of reaching all lanes being worked. Skid trails which were usable by a four-wheel-drive vehicle provided easy access to working areas.

All thinning was performed by crews of forestry students hired for summer work. Students were employed rather than regular woods workers because it was believed they would be easier to train quickly for the job where technical judgment is required.

The thinning crew included two saw operators in 1955 and two to four operators and a foreman in 1957. The usual field procedure was for two operators to work a single 2-chain-wide lane, but this varied depending upon how extensive thinnable areas were within the lane. Where only a few areas were to be thinned one operator was assigned.

It was impractical and unnecessary to mark each tree to be released ahead of the thinning crew. Instead, the crew was trained at the beginning of the season to select thinnable stands and trees for release by demonstrating the work on typical areas and by close supervision during the first two to three weeks. Thereafter, each saw operator independently chose stands for thinning and trees for release in accordance with the prescribed rules. Since the lanes were numbered, it was easy for the foreman to check the work of each operator, note mistakes, and give further instructions. If necessary, the operator returned to clean up areas missed.

Each saw operator kept a count of trees released, maintained his saw, and made minor repairs that could be done in the field. The foreman directed and inspected the work, assisted in making saw repairs, kept time and production notes, and whenever possible, thinned with an extra saw.

During the progress of work in 1957 it was found that overall thinning time for a management unit could be appreciably reduced by having the foreman inspect thinning lanes ahead of the crew and roughly map out and mark with orange tape areas in need of thinning. Some areas required very little, if any, thinning; in the mapping process this was discovered and the saw operator was diverted to another lane or area.

Two types of mechanical power saws were used for thinning: a 4 hp., circular, 88-tooth "brusheutter," and 2- and 3-hp. "sawette" chain saws (Figs. 5 and 6). Both types are portable saws carried by means of a sling over one or both shoulders. The latter arrangement is less tiring to the operator since the weight of the saw is more evenly distributed.

The circular-type saw appears best for cutting diameters up to about 4 inches. Cutting trees 2 inches or less in diameter can be done with this saw by literally "swinging" it through several stems at a time. For these diameters, setting the blade into each individual tree to be cut is not necessary, and it operates efficiently for diameters up to about 4 inches. The chain saw, by contrast, must be set into each tree cut. For diameters larger than 2 inches, the circular saw must also be set into each stem, and the margin of advantage between the two types therefore diminishes with increasingly large diameters. Both types allow cutting trees low to the ground, and both leave clean, flat stumps, but the circular saw is more easily handled. During the 1957 season, when both types were used, there were significant differences in repair rec-

[6] The influence of a mature tree has been observed to have suppressed the growth of a dense even-aged seedling stand on a natural regeneration area on the Blacks Mountain Experimental Forest to a distance of approximately 30 feet, substantiating these guides. Nine-year old seedlings within about 15 feet of the tree were 6 inches high, while those 30 feet and beyond were about 24 inches high.

ords, the circular saw having the better record. Although no direct comparison of production rates was made, the circular saw was clearly the more productive of the two.

The main advantage of these two types of saws is that they allow a degree of easy selectivity in thinning that is not possible with other types of power driven equipment. Because of terrain, rockiness, and heavy slash accumulation, self-propelled circular saws operating on the ground such as those described as being of use thinning jack pine in the Lake States (*1*), would not be practical over most of the area being thinned, especially on the mountain slopes. If tree selectivity is sacrificed, thinning with heavy machinery, such as a tractor equipped with cutting attachments or a disk or harrow, is probably possible in areas where the ground is not rocky. Considering, however, the scattered distribution of small groups of trees, thinning this way may be a doubtful method both cost-wise and operationally.

Production Rates and Costs

The total area covered amounted to 519.4 acres. Of this gross area only 44.8 acres, or 8.6 percent, were actually thinned. In the 1955 operation when released trees averaged only 375 per net acre thinned, the total time of all labor input, except transportation time, averaged 18.1 man-hours per acre or 2.6 minutes per released tree; in 1957 with an average of 674 released trees per acre, 36.6 man-hours per acre or 3.1 minutes per tree.

At $1.75 per hour, the labor cost amounted to 8 cents per released tree in 1955 and 9 cents per tree in 1957. Converted to a net acre thinned basis, this amounted to $31.75 and $63.94. The corresponding costs for saws in 1955 and 1957 were $4.10 and $6.41 per net acre, or about 1 cent per tree. The total cost per released tree was thus 9 cents in 1955 and 10 cents in 1957.

Production rates and costs varied from compartment to compartment. Average production costs, for instance, for the six different compartments thinned, were 8, 9, 9, 9, 12, and 13 cents per tree. The differences are the result of a combination of factors of which the following are important: different men, different combinations of types of saws, variations in saw repair time, variations in the terrain and forest stands, and differing field procedures. The highest costs were incurred in thinning very dense, mixed stands on slopes averaging 17 percent, while the lowest resulted from work done in the pure and more open stands on the flats. Since the objective of the project was to obtain preliminary information on the general level of costs, the records were not kept in a manner enabling statistical analysis of the importance of separate factors.

Distribution of labor input was recorded by the four categories, stringing, thinning, saw repair and maintenance, and supervision. It is striking that only a little more than half of the labor input represents time actually spent in thinning (Table 1). Equally significant is that 26 and 20 percent of the 1955

FIG. 5.—A 3 hp. sawette type chain saw used for thinning seedling and sapling stands at Blacks Mountain.

FIG. 6.—A 4 hp. brushcutter type circular saw.

and 1957 working season time, respectively, was spent in maintaining and repairing saws.

On the basis of actual thinning time only, the average production rate was 1.6 minutes per released tree, or about 38 trees released per hour. The highest actual hourly production for the project was 60 trees released per hour.

Because 90 percent of the total cost is attributable to labor, any increase in labor productivity would materially reduce the total. It is believed that the costs reported suggest some possibilities. The time required for machine repairs, for instance, could be reduced by exclusive use of the more dependable of the two types used. The saws used were the best available but need improvement. The fact that only 8.6 percent of the total area was thinned indicates that reducing the gross area covered would tend to reduce costs. Experience and exclusive use of the most efficient field procedures would also reduce costs.

A number of conditions encountered in the field were observed to affect production rates. In mixed stands of pine, white fir, and incense-cedar, the diameters of the latter two species usually were in the large sapling or small pole classes; this made thinning slower. The dense crowns of fir and cedar extending practically to ground level interfered with setting a saw into the bole. Dense stands affected production rates for several reasons: greater numbers of trees to be cut, movements hampered by accumulations of slash, and greater care required due to close spacing of cut trees to reserved trees. Height, aside from its association with diameter, affected production rates because taller trees more frequently bind the saw. They are also more difficult to clear from the working area.

Individual productivity by members of the thinning crew varied widely and consistently. It was related to physical ability to perform the work, incentive and willingness to do so persistently, and a mechanical aptitude equal to maintaining a saw.

TABLE 1.—DISTRIBUTION OF TIME AMONG FOUR CATEGORIES OF ACTIVITIES

Year and compartment	Labor input by activity					Trees released
	Stringing	Thinning	Saw repair & maint.	Supervision	Total	
1955	*Man-hours*					*No.*
G11-8	28.0	148.5	51.0	8.0	235.5	5,202
G12-10	13.0	73.0	29.0	—	115.0	2,715
G12-14	16.0	83.0	56.0	10.0	165.0	2,695
Total	57.0	304.5	136.0	18.0	515.5	10,612
Percent	11.1	59.0	26.4	3.5	100.0	—
1957						
P18-30	28.5	132.0	76.5	32.0	269.0	3,844
G4-15	18.0	117.5	33.5	37.5	206.5	4,764
G13-20	15.0	65.5	20.5	22.5	123.5	2,601
Total	61.5	315.0	130.5	92.0	599.0	12,209
Percent	10.5	53.0	20.4	16.1	100.0	—

Discussion

The importance of this project is that it relates a method of thinning, spacing, and type of equipment to production rates and costs. These data become especially significant in view of the fact that both the method of thinning and spacing appear silviculturally desirable. Also, costs seem sufficiently low to justify more study of precommercial thinning in ponderosa pine. Although the data presented satisfied the study objectives, they leave much to be desired. To be more universally useful, we need comparative production data as reflected by such variables as stand density, slope, stand composition, and proportion of area thinned to total area. In the absence of such data, the results reported can serve as an indication of what thinning costs can be expected in areas similar to Blacks Mountain, and as a basis for value judgments on thinning decisions in other parts of the ponderosa pine range.

Summary

In 1955 a precommercial thinning was begun in ponderosa pine seedling and sapling stands on the Blacks Mountain Experimental Forest. Continued in 1957, a total of 519.4 acres have been covered and more than 22,000 trees released on 44.8 acres. The thinning, combining mechanical spacing and low thinning methods, was aimed at releasing selected trees at an average spacing of 9 feet to improve growth in overdense stands. Some mistletoe control work was done in conjunction with the thinning.

Two types of portable, mechanical power saws were used at an average cost per released tree of $0.01. Labor costs, including charges for stringing working areas and saw maintenance and repair, averaged $0.08 per released tree in 1955 and $0.09 in 1957. The total cost for both machines and labor thus was $0.09 to $0.10 per tree. Gross acre costs ranged from $1.97 to $6.26 and averaged $4.19. Net acre costs ranged from $23.45 to $84.86 and averaged $48.61.

Production rates ranged from 11.7 to 45.6 man-hours per net acre, and averaged 24.9 man-hours, or about three man-days. On a gross acre basis, 2.0 man-hours were required. Converted to a tree basis, thinning required an average of 2.8 man-minutes per released tree. These figures include all time involved in stringing, thinning, saw repair and maintenance, and supervision. Considering thinning time only, the average time required per gross acre was 1.3 man-hours; per net acre, 13.0 man-hours; and per tree, 1.6 man-minutes.

Literature Cited

1. DOSEN, R. C., J. H. STOECKELER, and E. G. KILP. 1957. Mechanized thinning in jack pine saplings. Jour. Forestry 55:201-204.
2. GAINES, EDWARD M., and E. S. KOTOK. 1954. Thinning ponderosa pine in the Southwest. Rocky Mountain Forest and Range Expt. Sta. Paper No. 17, 20 pp.
3. HAWLEY, RALPH C. 1935. The practice of silviculture. Third ed. 340 pp., illus. Wiley & Sons, New York.
4. MEYER, WALTER H. 1938. Yield of even-aged stands of ponderosa pine. U. S. Dept. of Agric. Tech. Bull. No. 630, 60 pp., illus.
5. MOWAT, EDWIN L. 1953. Thinning ponderosa pine in the Pacific Northwest. Pacific Northwest Forest and Range Expt. Sta. Res. Paper No. 5, 24 pp.

Humus Depth in the Northeast

Howard W. Lull

ON ENTERING the forest primeval, did the Pilgrim Fathers step from Plymouth Rock into knee-deep humus? Or did they walk onto a forest floor that was similar in depth to that of present forest stands in the Northeast?

This question has practical pertinence to flood control in the Northeast. The deeper the humus, the more water it can store. This is particularly important in the Northeast where forest soils are shallow and water storage is limited. To the extent that water storage can be increased through deeper accumulations of humus, costly annual flood bills and property destruction can be reduced.

So the question is: with protection from fire and grazing, could considerably greater depths of humus be accumulated in the forest areas of the Northeast?

Humus, in this paper as in Lutz and Chandler's (1946) text, is considered to be the plant and animal residue, litter excluded, that is decomposing. It includes the F-layer (partially decomposed litter) and the H-layer (well-decomposed) described in the accepted classification of Hoover and Lunt (*6*). In this paper, except where noted, humus does not include the A_1 layer of mineral soil mixed with organic materials. The A_1, containing 10 to 20 percent organic matter, is not an organic layer and is not comparable to the overlying organic materials in water-storage capacity. Parenthetically, almost all of the humus types examined in the field and those cited in the literature were mors, which do not possess an A_1 layer.

The water-storage function of humus consists of its capacity to retain against the force of gravity approximately 40 percent water by volume, and also to detain or store temporarily about an equal amount (*18*). Thus an addition of 1 inch of humus will increase the retention storage of the soil 0.4 inch. An equivalent amount of water could be stored in about 5 inches of fine sand or 3 inches of silt loam or clay.

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Search for an Answer

Whether greater humus depths could be accumulated in Northeastern forests depends first on potential depths that, under protection, might be accumulated, and second, on humus depths beneath present-day stands. Estimates of potential humus depths were derived from measurements taken in 18 virgin stands scattered throughout the Northeast (Fig. 1) and from several literature references. Actual accumulations in present-day stands were obtained from forest and watershed studies that have been conducted in part by the Northeastern Forest Experiment Station (Fig. 1), and from humus depths cited in the literature.

In compiling these data, only well-drained upland conditions were visited or considered. Humus, of course, accumulates to great depths in swamps and bogs, sizable areas of which (40 acres and greater) make up about 1 percent of the forest area of the Northeast (*17*). These deposits, however, accumulate and persist under wet conditions and do not function in water storage as does upland forest humus.

Humus depths in virgin stands. —Humus depths were measured in 18 virgin stands during the summer months of 1957 and 1958

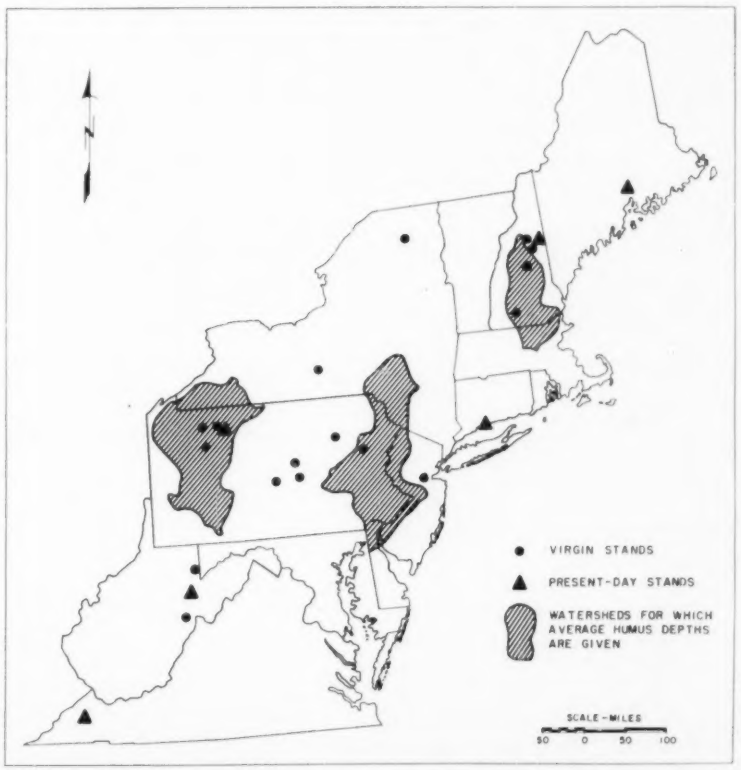

FIG. 1.—Locations where humus depths were measured.

TABLE 1.—HUMUS DEPTHS IN VIRGIN STANDS IN THE NORTHEAST

Location	Forest type	Latitude	Elevation	Organic material	
				Depth	Standard deviation
			Feet	*Inches*	*Inches*
1. Paul Smiths Experimental Forest, Franklin County, Paul Smiths, N. Y.	Maple, birch, beech	44° 26′	1,700	5.2	1.8
2. Paul Smiths Experimental Forest, Franklin County, Paul Smiths, N. Y.	Hemlock	44° 26′	1,700	9.5	2.2
3. Nancy Brook, White Mountain National Forest, Carroll County, Bartlett, N. H.	Spruce	44° 07′	1,900	16.4	4.6
4. Mt. Passaconaway Trail, White Mountain National Forest, Carroll County, Wonalancet, N. H.	Hemlock, beech, birch	43° 56′	2,200	4.4	2.4
5. Center Harbor (private), Belknap County, Center Harbor, N. H.	White pine, hemlock, beech	43° 43′	500	2.3	1.2
6. Thatcher Forest (private), Hillsboro County, Hancock, N. H.	White pine	42° 58′	900	1.4	1.5
7. Robert H. Treman State Park, Tompkins County, Ithaca, N. Y.	Red pine	42° 26′	1,050	3.1	0.9
8. Hearts Content, Allegheny National Forest, Warren County, Cherry Grove, Pa.	White pine, beech	41° 42′	1,800	2.9	1.8
9. Tionesta Natural and Scenic Area, Allegheny National Forest, Warren and McKean Counties, Ludlow, Pa.	Hemlock, beech	41° 38′	1,900	2.4	1.9
10. Cook Forest State Park, Clarion and Forest Counties, Cooksburg, Pa.	White pine, hemlock	41° 24′	1,330	2.8	2.7
11. Ricketts Glen State Park, Luzerne County, Red Rock, Pa.	White pine, hemlock	41° 18′	1,400	2.9	1.2
12. Bear Creek (private), Luzerne County, Bear Creek, Pa.	White pine, hemlock	41° 11′	1,600	2.4	1.2
13. Joyce Kilmer State Forest Monument, Union County, Laurelton, Pa.	White pine, hemlock	40° 56′	1,900	1.3	1.6
14. Snyder-Middleswarth State Park, Snyder County, Troxelville, Pa.	Hemlock	40° 47′	1,500	2.8	2.7
15. Allan Seeger State Forest Monument, Mifflin County, McAlevys Fort, Pa.	White pine, hemlock	40° 42′	1,050	4.3	2.5
16. William L. Hutcheson Memorial Forest, Somerset County, East Millstown, N. J.	Hardwood: oak, beech, hickory	40° 30′	46	1.6	1.0
17. Cathedral State Park, Preston County, Aurora, W. Va.	Hemlock	39° 15′	2,500	1.9	0.9
18. Gaudineer Knob, Randolph County, Cheat Bridge, W. Va.	Red spruce	38° 53′	4,200	7.3	4.9

(Table 1). Depths were measured every 2 feet along 50-foot transects located under representative cover. Two to four transects were laid out in each stand.

Three of the stands. Nos. 1, 4, and 16 (Table 1) were predominantly hardwood stands; Nos. 3 and 18 were spruce; No. 7 was red pine; and the remainder were predominantly hemlock or white pine or mixtures of these two species. Depths of the accumulated F and H layers were easily measured. In almost all stands, demarcation between humus and mineral soil was marked distinctly by podzolization.

Greatest accumulations occurred under spruce in both the northern (16.4 inches) and southern (7.3 inches) parts of the region; hemlock and hardwood stands in the Adirondacks gave the next greatest humus depths, 9.5 and 5.2 inches. With the exception of the 7.3 inch depth for the spruce stand in West Virginia, all other areas south of the Adirondacks had humus depths between 1.3 and 4.3 inches. Eleven of these 13 stands had average depths of less than 3 inches.

Standard deviations ranged from 23 to 123 percent of the mean depths. Greater deviations than these probably occur under stands where uprooting is more common, resulting in the type of humus-depth variation that has been pictured by Lutz and Griswold (*12*). Most of the stands examined were even-aged, and soil-profile disturbance from windfall was not common.

Depths like those given in Table 1 for spruce stands have been reported by other observers. Diebold (*4*) found a median depth of 14 inches for an unburned spruce-fir slope type in the Adirondacks, with some depths in excess of 20 inches. According to Coile (*3*), bare rocks on the plateau of eastern West Virginia were once covered with 8 to 16 inches of humus developed from spruce. Studies by the Appalachian Forest Experiment Station (now the Southeastern Forest Experiment Station) in West Virginia indicated that spruce and hardwood

litter 12 to 18 inches deep was destroyed by the 1924 burn (*14*).

Lesser depths have been reported for humus under virgin hemlock and hardwoods. From analysis of data from 68 plots located in virgin forest remnants in southeastern New Hampshire, Cline and Spurr (*2*) reported humus depths of 1.90 inches for hemlock and white pine stands, 1.55 for hemlock-hardwood, and 1.35 inches for hardwood stands. Diebold (*4*) found median depths of 4 inches for unburned spruce-hardwood and 3 inches for unburned northern hardwoods in the Adirondacks. Bernard Frank found an average humus depth of 4.5 inches under a virgin hardwood stand in the mountains of western Virginia.[1]

Thus, humus depths under virgin spruce-fir in the northeastern mountains ranged from 8 to 16 inches; humus depth under hemlock and hardwoods in the Adirondacks ranged from 3 to 9 inches, and from about 2 to 5 inches elsewhere in the Northeast.

Actual humus depths in present-day stands.—Humus-depth measurements at four experimental forests in the Northeast, in three river basins, and observations and measurements in New England and Virginia, as shown in Table 2, give some idea of the magnitude of present-day accumulations. Experimental forest values from Maine and New Hampshire were taken during plot establishment for a frost study (*15*); each value is the mean of 10 measurements taken within a 50-foot plot.

The average humus depth from the Kane Experimental Forest was computed from 70 measurements taken by the author. The Fernow value is the mean humus depth (including the F, H, and A_1 layers) from 960 measurements taken on five experimental watersheds. The river basin values are mean depths from flood-control surveys; for the Delaware, they represent measurements taken at over 600 locations. The Virginia value is the mean depth computed from four measurements taken in each of 20 hardwood stands by Bernard Frank.[2]

These humus depths indicate that poletimber and sawtimber accumulations range generally from 1 to 3 inches. These values, of course, do not apply to spruce-fir stands, where the depths may range from practically no humus to several inches, depending on past fire and cutting history.

Young stands of hardwoods or conifers have less humus. Lutz (*10*) pointed out that in young stands of the red cedar-gray birch association in southern New England there are practically no humus layers. During the frost study of Pierce et al. (*15*) mean humus depths of 1 to 2 inches were found at the Penobscot, Paul Smiths, Bartlett, and Kane Experimental Forests in coniferous plantations 30 to 35 years old and under hardwood reproduction, about 10 feet tall, that had come in after clearcutting.

Discussion

Before comparing humus depths of virgin stands to those of present-day stands, one might ask: Do the virgin stand humus depths represent potential maximum accumulations? Are they similar to those in the forest primeval?

Potential humus depths.—Very likely, the range of humus depths shown in Table 1 is representative of potential accumulations. The 18 areas examined are remnants of the original forest cover. From the literature describing these areas, trees ranged between 150 and 400 years old. Little or no cutting was evident. All transects were located so as to run through uncut groups of the virgin timber.

Most of these stands were even-aged and probably originated from forest catastrophies such as fire or wind-throw. Though no evidence of recent fires was observed, the areas may have been burned long ago, with some consequent reduction in humus depth. Lutz (*11*) reported that at the Hearts Content area in Pennsylvania, fire scars indicated the occurrence of five fires dating back as far as 1749.

Reserving of these areas in the past 30 to 50 years as public parks and encircling them with access roads have provided considerable fire protection and permitted unchecked humus development. If, as Morey's humus depth-age curves indicate (*18*), equilibrium depth is reached in second-growth stands 45 to 80 years after clearcutting, we can assume that an equilibrium depth has been established in these areas after a half-century of fire protection.

The degree of fire protection these areas have received leads to the conjecture that their present humus depths may be greater than those accumulated in parts of the original forests. For the original upland forest, as many investigators have pointed out, was burned often by lightning fires or by fires set by Indians to improve their hunting grounds:

> The Salvages are accustomed to set fire of the country in all places where they come; and to burn it twize a yeare, vize, at the Spring, and at the fall of the leafe. The reason that moves them to do so, is because it would be otherwise so overgrown with underweedes that it would be all a copice wood, and the people could not

TABLE 2.—PRESENT-DAY HUMUS DEPTHS IN POLETIMBER AND SAWTIMBER STANDS

Location	Forest type	Humus depth
		Inches
Penobscot Expt. Forest, Bangor, Maine	Conifers-hardwood	1.4 - 2.6
Bartlett Expt. Forest, Bartlett, N. H.	Conifers-hardwood	1.2 - 2.9
Merrimack River Watershed[1]	Conifers-hardwoods	1.9 - 3.1
Connecticut (*9*)	Hardwoods	1.2
New Haven, Conn. (*10*)	Hardwoods	0.75- 2.0
	Hardwoods-hemlock	1.75- 2.75
Allegheny River Watershed (*16*)	Hardwoods-conifers	2.0 - 2.6
Kane Expt. Forest, Kane, Pa.	Hardwoods	1.5
Delaware River Watershed[1]	Hardwoods-conifers	1.2 - 1.8
Fernow Expt. Forest, Parsons, W. Va.	Hardwoods	2.0
Western Virginia, Norton, Va.	Hardwoods	2.0

[1]Unpublished data, Region 7, U. S. Forest Service, Upper Darby, Pa.

[1]Unpublished data, U. S. Forest Service, Washington, D. C.

[2]Op. cit.

> be able in any wise to passe through the country out of a beaten path.

Such were conditions in eastern Massachusetts as reported in 1632 and cited by Bromley (*1*). Hawes (*5*) and Bromley (*1*) also cite a 1634 publication, *New England's Prospect*, by William Wood:

> The timber of the country grows straight and tall, some trees being twenty, some thirty foot high before they spread their branches. . . . And whereas it is generally conceived that the woods grow so thicke that there is no cleare ground than is hewed out by labour of man; it is nothing so; in many places divers acres being cleare, so that one may ride a hunting in most places of the land, if he will venture himself for being lost; there is no underwood saving in swamps, and low grounds . . . for it being the custom of Indians to bourne the wood in November when the grass is withered and leaves dryed . . . which otherwise would overgrow the country, making it impassable, and spoil their much affected hunting. . .

These fires were apparently ground fires that by consuming undergrowth and litter may well have kept humus from reaching equilibrium depth.

Potential and actual depths.—If the humus depths given in Table 1 are potentials, except for spruce and the hemlock in the Adirondacks, they range about 1 inch deeper than present accumulations under sawtimber and poletimber stands. Roughly, humus depths in the virgin areas range from 1 to 5 inches whereas in the sawtimber-poletimber stands they range from 1 to 3 inches.

These latter stands make up about two-thirds of the commercial forest area of the Northeast. If, under protection, their humus depth could be increased 1 inch, this would add about 0.4 inch to retention storage capacity. Retention storage of shallow soils 2 feet deep would be increased by perhaps 10 percent, thereby increasing their flood-protection function. (Shallow-soil areas are common to the Northeast. In the Merrimack River watershed, for instance, there are over 800,000 acres of forest land, 28 percent of the watershed area, occupying light-textured soils less than 2 feet deep and with a retention water storage capacity of 3 inches or less.)

The addition of 1 inch of humus would also add about 0.4 inch of detention storage for temporary storage of rainfall. This storage, for flood-control purposes, has greater significance than retention storage because flood-producing rainfalls often occur at times when the soil is wet and retention storage is already satisfied.

For the remaining one-third of the area in young growth, some 21,000,000 acres (somewhat more than the combined area of the New England States except Maine), increasing humus depth would have an even greater effect. Present accumulations may range from 0 to 1 inch—perhaps one-third or less of the potential. Addition of 3 inches of humus, over a period of protection, would triple the storage effect considered above. Here, then, is the major area in the Northeast for increased flood protection through forest protection.

Spruce stands require separate consideration. Where this type still occurs in the New England Mountains, the Adirondacks, and the Alleghenies, humus accumulations of a foot or more may be found. Cutting, followed by fire and invasion of hardwoods, has drastically reduced their original area. Hawes (*5*), summarizing evidence on early forest conditions in New England, states that the mountains of New Hampshire and Vermont were covered with spruce forests. These ranges are now almost entirely in northern hardwoods, and spruce now occupies only the ridge tops. Likewise, in the southern part of its range, spruce occupies not more than one-tenth of its original area (*8*). In the northeastern mountains, only in the Adirondacks "forever wild" region can large areas of spruce be found.

In the areas where spruce has disappeared, totalling perhaps 2,000,000 acres, humus depths are now considerably more shallow than in the original forest. There is little reason to believe that spruce will ever be reestablished in these areas and the former humus depths accumulated.

Back to the Pilgrims

All this gives at least a tentative answer to the question we began with. Apparently the Pilgrim Fathers did not step from Plymouth Rock into knee-deep humus. Instead, depths then may very well have been not much more than an inch or so deeper than the depths we have now in our upland poletimber and sawtimber stands.

The few data given also serve to indicate the magnitude of humus depth accumulation in the Northeast. The literature on humus largely concerns classification and is noteworthy for the absence of measurement data; "mor," for instance, has been a familiar though dimensionless term.

There is much to learn about humus. A few obvious research projects were suggested in a paper by Trimble and Lull (*18*). There are many others. Forest humus development offers an interesting field for exploration for the botanist, ecologist, zoologist, and pathologist. Jacot, for instance, once suggested that fire may so reduce the mite population as to reduce significantly the rate of humus decay (*7*).

In the same vein, what would periodic application of insecticides or fungicides on the forest floor do to humus development? And the hydrologic function: How fast does humus dry? Wet? In winter? Summer? How temporary is "temporary" storage. How does an inch of humus compare hydrologically with an inch of pea gravel? How about humus accumulation in respect to macro-relief? Micro-relief?

Answers to these and many other questions may provide the information needed to develop the indicator possibilities of humus in forest management and its hydrologic potential for watershed management.

Literature Cited

1. BROMLEY, STANLEY W. 1935. The original forest types of southern New England. Ecol. Monog. 5:61-89.
2. CLINE, A. C., and S. H. SPURR. 1942. The virgin upland forest of central New England. Harvard Forest Bul. 21. 58 pp., illus.

3. COILE, T. S. 1938. Podzol soils in the southern Appalachian Mountains. Soil Sci. Soc. Amer. Proc. 3:274-279.
4. DIEBOLD, C. H. 1941. Effect of fire and logging upon the depth of the forest floor in the Adirondack Region. Soil Sci. Soc. Amer. Proc. 6:409-413.
5. HAWES, AUSTIN F. 1923. New England Forests in retrospect. Jour. Forestry 21:209-224.
6. HOOVER, M. D., and H. A. LUNT. 1952. A key for the classification of forest humus types. Soil Sci. Soc. Amer. Proc. 16:368-370.
7. JACOT, ARTHUR PAUL. 1939. Reduction of spruce and fir litter by minute animals. Jour. Forestry 37: 858-860.
8. KORSTIAN, CLARENCE F. 1937. Perpetuation of spruce on cut-over and burned lands in the higher southern Appalachian Mountains. Ecol. Monog. 7:125-167.
9. LUNT, HERBERT A. 1948. The forest soils of Connecticut. Conn. Agr. Expt. Sta. Bul. 523. 93 pp., illus.
10. LUTZ, HAROLD J. 1928. Trends and silvicultural significance of upland forest successions in southern New England. Yale Univ. School Forestry Bul. 22. 68 pp., illus.
11. ———. 1930. The vegetation of Heart's Content, a virgin forest in northwestern Pennsylvania. Ecol. 11:1-29.
12. ———, and F. S. GRISWOLD. 1939. The influence of tree roots on soil morphology. Amer. Jour. Sci. 237:389-400.
13. ———, and ROBERT F. CHANDLER, JR. 1946. Forest soils. 514 pp., illus. John Wiley and Sons, Inc., New York.
14. MUNNS, E. N., and IVAN H. SIMS. 1936. Forests in flood control. Supplemental report to the Committee on Flood Control, House of Representatives, 74th Cong., 2nd Sess., on H.R. 12517.
15. PIERCE, ROBERT S., HOWARD W. LULL, and HERBERT C. STOREY. 1958. Influence of land use and forest conditions on soil freezing and snow depth. Forest Sci. 4:246-263.
16. SARTZ, R. S., and W. D. HUTTINGER. 1950. Some factors affecting humus development in the northeast. Jour. Forestry 48:341-344.
17. SPINNER, GEORGE P. 1955. Wildlife-wetlands in the Northeast. A progress report. Fish and Wildlife Service. Boston, Mass. 16 pp., illus.
18. TRIMBLE, G. R., JR., and HOWARD W. LULL. 1956. The role of forest humus in watershed management in New England. U. S. Forest Serv., Northeast. Forest Expt. Sta. Paper 85. 34 pp., illus.

Damage From Increment Borings in Bottomland Hardwoods

E. Richard Toole and John L. Gammage

THIS PAPER REPORTS a study of the amount of stain and decay that developed from increment-borer holes in five species of bottomland hardwoods. Though the 0.2-inch holes made by conventional borers are often considered insignificant, it appears that they may result in serious defect.

Methods

In September 1956 and again in March 1957 four borings 3 to 6 inches deep were made in each of 10 trees of Nuttall oak (*Quercus nuttallii* Palmer), green ash (*Fraxinus pennsylvanica* Marsh.), sugarberry (*Celtis laevigata* Willd.), sweetgum (*Liquidambar styraciflua* L.), and eastern cottonwood (*Populus deltoides* Bartr.). The trees, on the Delta Experimental Forest near Stoneville, Mississippi, were 10 to 14 inches in d.b.h. Usual increment-borer practice was followed. The holes were not slanted, nor were disinfectants used. Plugging was not tested, as studies elsewhere [1, 2] have indicated that it is ineffectual. The autumn holes were all installed 20 degrees to one side of the cardinal directions, that is, at azimuths of 20, 110, 200, and 290 degrees, and about 3½ feet above ground. The spring holes were at azimuths of 340, 70, 160, and 250 degrees, and about 5 feet above ground. Healing and surface defect were measured at 6-month intervals.

In September 1958, two growing seasons after installation, the trees were felled and dissected, and discoloration and visible decay measured. Cultures were made from representative samples.

THE AUTHORS are stationed at the Delta Research Center, which is maintained at Stoneville, Mississippi, by the U. S. Forest Service in cooperation with the Mississippi Agricultural Experiment Station and the Southern Hardwood Forest Research Group.

[1]Hepting, G. H., E. R. Roth, and B. Sleeth. Discolorations and decay from increment borings. Jour. Forestry 47: 366-370. Illus. 1949.

[2]Lorenz, R. C. Discolorations and decay resulting from increment borings in hardwoods. Jour. Forestry 42:37-43. Illus. 1944.

Results

After two growing seasons the great majority of wounds in all species except sugarberry were callused over (Table 1). Cambial dieback around the holes accounted for the slower rate of healing with sugarberry. In Nuttall oak and sweetgum, holes made in spring healed faster than those made in the fall. In general, the rates of healing were much faster than those reported by Hepting et al.[3] in the southern Appalachians.

When the trees were sectioned, nearly all of the holes were found to have discolorations or stains around them (Table 2). The horizontal spread of discoloration was only slightly wider than the diameter of the holes (Fig. 1*D*). The vertical range was considerably greater, and extended about the same distance above the holes as below. The stains varied from black to light gray and brown.

The data on extent of stain were subjected to analysis of variance, which showed highly significant differences among tree species, and between seasons. In addition, the interaction between species and season was highly significant.

For autumn and spring holes combined, sugarberry had a mean vertical stain extent of 9.8 inches with a maximum of 56 inches;

[3]Op. cit.

TABLE 1.—CLOSURE OF INCREMENT BORER HOLES[1]

Species	Holes made in fall		Holes made in spring	
	Healed after 1 growing season	Healed after 2 growing seasons	Healed after 1 growing season	Healed after 2 growing seasons
	Percent			
Eastern cottonwood	98	100	100	100
Green ash	100	100	100	100
Nuttall oak	81	97	98	100
Sweetgum	75	98	100	100
Sugarberry	20	78	18	75

[1]Each percentage based on 40 holes, except that Nuttall oak bored in fall was represented by 36 holes.

TABLE 2.—DISCOLORATIONS TWO GROWING SEASONS AFTER INCREMENT BORING

Species	Holes made in fall		Holes made in spring	
	Holes with stain	Mean vertical extent[1]	Holes with stain	Mean vertical extent[1]
	Percent	*Inches*	*Percent*	*Inches*
Eastern cottonwood	92	8.2	73	7.6
Green ash	100	3.2	100	3.0
Nuttall oak	100	9.1	100	11.0
Sweetgum	100	10.7	100	9.5
Sugarberry	100	13.1	100	6.4

[1]Holes with no stain were excluded from the computations.

Nuttall oak a mean of 10.1 inches and a maximum of 40 inches; sweetgum a mean of 10.1 inches and a maximum of 28 inches; eastern cottonwood a mean of 7.9 inches with a maximum of 20 inches; and green ash a mean of 3.1 inches and a maximum of 12 inches. A "t" test showed no significant differences between sugarberry, sweetgum, and Nuttall oak; but these species had significantly more stain than cottonwood and green ash; and ash had significantly less stain than all other species.

In sugarberry, but not in other species, holes made in the fall had significantly more stain than those made in the spring (significance at the 1-percent level by "t" test).

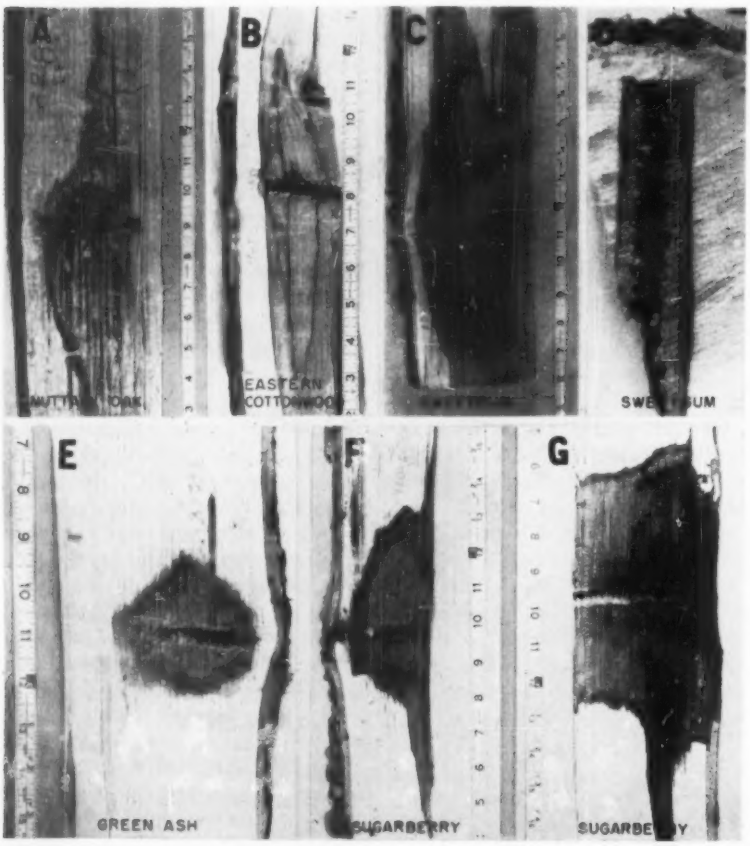

FIG. 1.—Sections through increment-borer holes after two growing seasons. All except D are longitudinal sections.

Cultures were attempted from some of the stained wood. Many samples yielded no organism, but *Phialophora* spp., *Fusarium* spp., *Penicillium* spp., *Curvularia* spp., *Nigrospora* spp., and *Diplodia*-like cultures were isolated. Identifications were made by Ross W. Davidson of the U. S. Forest Disease Laboratory at Beltsville, Maryland. The variety of organisms isolated indicates that no one fungus or small group of fungi is specifically adapted to invasion through increment-borer holes. Although these fungi have been found associated with stain in lumber, they are not the commonest lumber stainers.

The mean and maximum vertical extents of rot in the infected trees varied with species (Table 3). For autumn and spring borings together, means and maxima were 6.4 and 10 inches for cottonwood; 4.7 inches and 8 inches for sugarberry; 2.5 and 6 inches for sweetgum; 1.7 and 3.5 inches for Nuttall oak. In ash, only one hole showed rot. An analysis of variance of the amount of rot showed highly significant differences among tree species. The species-season interaction was significant.

When sound as well as rotten holes were considered, a "t" test found that sweetgum had significantly more rot than all other species; sugarberry had significantly less than sweetgum and more than the others; cottonwood significantly less than sweetgum and more than ash and Nuttall oak. The last two species were not significantly different.

Five rot fungi were isolated. The

Forest Disease Laboratory identified two as *Peniophora* sp., one as *Xylaria* sp., one as *Polyporus dryophilus*, and one as *Polyporus adustus*.

Discussion and Summary

Though the borer holes callused over rapidly, stain developed around most of them. The average vertical extent of discoloration was 3 to 13 inches in 2 years, depending upon the tree species and whether the holes were made in spring or in fall. Horizontal spread was very small. These findings are within the range reported by Hepting *et al.* from other areas where healing was slower.

Lorenz, working with hardwoods in the Lake States,[4] concluded that the stain arising from borer holes is primarily physiological in origin. In the present study, the lack of isolates from many samples of stained wood was consistent with this proposition. However, the six stain fungi that were isolated probably caused part of the discoloration.

The exceptional rot infection of sweetgum bored in spring cannot readily be explained. Possibly the borings coincided with a heavy release of spores in the vicinity of these trees, which were about two miles from the others. The spring-bored sweetgums apart, incidence of rot was less than that reported by Hepting et al., perhaps because the holes closed more rapidly in this study.

With or without the rot, the stain that developed from nearly all borer holes would constitute a defect in logs intended for factory lumber or veneer. Where valuable hardwoods are involved, it appears that increment borings should be held to a minimum and holes made no deeper than necessary.

TABLE 3.—DECAY TWO GROWING SEASONS AFTER INCREMENT BORING

Species	Holes made in fall		Holes made in spring	
	Holes with rot	Mean vertical extent[1]	Holes with rot	Mean vertical extent[1]
	Percent	*Inches*	*Percent*	*Inches*
Eastern cottonwood	12.5	6.4	0	0
Green ash	2.5	4.0	0	0
Nuttall oak	20.0	1.5	5.0	1.8
Sweetgum	15.0	2.3	80.0	2.6
Sugarberry	22.5	5.1	12.5	4.2

[1]Holes with no decay not included in these figures.

[4]Op. cit.

Contents and Title Page Bound in JOURNAL

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The Relative Susceptibility of Eight Pine Species to European Pine Shoot Moth Attack in Michigan

William E. Miller and
H. J. Heikkenen

THE EUROPEAN PINE shoot moth, *Rhyacionia buoliana* (Schiff.), has been reported to attack 19 species and varieties of pine (*5*). Several attempts have been made to rate some of these pines according to their relative susceptibility to attack by the shoot moth. Holst and Heimberger (*3*), for example, put eight pine species and varieties into four categories ranging from "very susceptible" to "very resistant." However, a weakness of all such work in the past is that it has been based on visual impressions. Ratings derived from quantitative data would be far more desirable.

This paper presents susceptibility ratings derived from a study of the insect population levels found on eight pine species growing in Ottawa County, Mich. This area was chosen because it contained young pine plantations consisting of more than one species; also because the European pine shoot moth had been prevalent since the early 1950's. All data were gathered during the spring of 1958 when the insect was in the pupal stage.

Methods

Six plantations were studied which contained red pine along with 1 to 6 other pine species. These plantations had been infested by the shoot moth for at least the preceding 4 years. They were between 8 and 12 years old from seed, but the trees in any particular one were the same age. None of the plantations had closed.

THE AUTHORS are forest entomologist and research forester respectively at the Lake States Forest Experiment Station's field unit in East Lansing, Mich., which is maintained in cooperation with Michigan State University.

After a plantation was selected for study, the total numbers of insects and shoots on each sample tree were counted. The insects developing on a tree make an easily defined natural unit, and therefore the data from each tree were considered a replication.

Efforts were made to secure data in such a way that differences would be due to different species of pine and not to different sites. Counts on the same pine species in the same plantation were almost always made on adjacent trees; those on different species sometimes were made on adjacent trees, but never on trees more distant from one another than 10 yards. From 5 to 10 trees were studied per pine species in each plantation, totaling from 10 to 50 trees per pine species for the whole study.

The following pines were included in the investigation [nomenclature after Little (*4*)]:

1. Jack pine, *Pinus banksiana* Lamb.
2. Austrian pine, *Pinus nigra* Arnold.
3. Ponderosa pine, *Pinus ponderosa* Laws.
4. Red pine, *Pinus resinosa* Ait.
5. Pitch pine, *Pinus rigida* Mill.
6. Eastern white pine, *Pinus strobus* L.
7. Scotch pine, *Pinus sylvestris* L.
8. Virginia pine, *Pinus virginiana* Mill.

The amount of damage which the shoot moth does to a tree de-

TABLE 1.—RELATIVE SUSCEPTIBILITY OF VARIOUS SPECIES OF PINE TO EUROPEAN PINE SHOOT MOTH ATTACK IN EACH OF SIX PLANTATIONS OTTAWA COUNTY, MICH., 1958

Plantation	Pine species	Number trees examined	Mean height in feet	Mean number shoots per tree	Mean number insects per tree	Mean insect-shoot ratio
1	Red	10	3.6	55.0	9.9	.18
	Scotch	10	4.2	220.6	2.0	.01
2	Red	10	3.4	45.6	8.6	.19
	Scotch	10	4.4	205.0	5.4	.03
	Jack	5	5.0	448.4	0.4	.001
	White	5	3.7	156.4	0	0
3	Red	10	5.5	160.7	24.9	.15
	Austrian	10	4.3	95.3	8.6	.09
	Scotch	10	6.3	243.8	17.5	.07
	Ponderosa	10	6.1	102.8	6.9	.07
4	Red	5	2.8	77.0	32.6	.42
	White	10	3.5	(1)	0.2	.001
	Jack	10	6.1	(1)	0.3	.001
5	Red	5	3.4	83.6	31.0	.37
	White	10	3.9	(1)	.05	.003
6	Red	10	3.0	51.7	3.3	.06
	Austrian	10	2.2	28.8	1.3	.05
	Scotch	10	2.3	99.7	0.3	.003
	Jack	10	4.9	(1)	0.1	.0004
	Virginia	10	4.6	—	0[2]	0
	Pitch	10	3.3	—	0[2]	0

[1]Assumed to be the same as for the respective species in Plantation 2.
[2]Much wider searching on nonsample trees revealed an occasional pupa.

TABLE 2.—COMPOSITE RELATIVE SUSCEPTIBILITY OF EIGHT SPECIES OF PINE TO EUROPEAN PINE SHOOT MOTH ATTACK, OTTAWA COUNTY, MICH., 1958

Susceptibility rating	Pine species	Number trees observed	Mean insect-shoot ratio	Mean no. insects per tree
High	Red	50	0.2[1]	15.5
Medium	Austrian	20	0.07	4.9
	Ponderosa	10	0.06	6.9
	Scotch	40	0.03	6.5
Low	White	25	0.002[2]	0.3
	Jack	25	0.001[2]	0.2
	Virginia	10	0.000	0.0[3]
	Pitch	10	0.000	0.0[3]

[1]Significantly different from ratios of the medium group at the 1-percent level of probability.
[2]Not included in the analysis; ratios inferred to be statistically different from those of high and medium groups.
[3]Much wider searching on nonsample trees revealed an occasional pupa.

pends not only on the number of insects working on it, but also on the number of shoots which the tree has. To illustrate, ten insects would injure proportionately more shoots on the average red pine tree in this study than on the average Scotch, because the red pine had less than half as many shoots as the Scotch (Table 1). Insect counts were therefore divided by shoot counts from each sample tree. The resulting "insect-shoot ratios" constituted an index of damage. They further provided a basis for directly comparing insect damage between host species regardless of such differences among the trees as age, number of shoots inherently produced, and amount of adventitious growth resulting from previous shoot moth attack.

The analysis of variance was applied to the mean insect-shoot ratios. The Studentized Range (2) made it possible to adapt a multiple comparison between means by the analysis of variance.

Results

A wide range of insect-shoot ratios was obtained, but they separated into three distinct groups (Table 2). The red pine insect-shoot ratio of 0.2 for all study plantations was significantly higher than all the other ratios, and therefore red pine was rated as highly susceptible. Ponderosa, Austrian, and Scotch pine, with insect-shoot ratios ranging from 0.03 to 0.07, constituted a middle group which was of medium susceptibility. Pitch, Virginia, jack, and eastern white pine had negligible ratios and were therefore considered low in susceptibility. Within each plantation, the relative susceptibilities of the species also followed the same pattern (Table 1).

FIG. 1.—In this plantation (*Below*) a row of badly damaged red pine (specimen at left) is growing adjacent to a row of lightly damaged Scotch pine (specimen at right). Both species were 8 years old from seed.

FIG. 2.—A roadside mixture (*Right*) of badly damaged red pine (left and right) and lightly damaged Austrian (center) in Michigan.

These results corroborate some but not all opinions previously expressed about susceptibility of various pines to shoot moth attack. Holst and Heimberger (*3*) rated red pine "very susceptible" and Austrian "resistant" in North America. However, their rating of Scotch pine in the "very susceptible" category with red contrasts with the moderately susceptible rating of Scotch pine developed in the present study.

General observations by the writers throughout Lower Michigan have corresponded with the conclusions based on the data from the study plantations. This is illustrated in Figures 1 and 2. In Figure 1, a row of badly damaged young red pine is growing beside a row of almost undamaged Scotch. In Figure 2, the effects of an infestation in a mixed roadside planting of older trees are shown. Here the crowns of red pine have been thinned out, and spike tops have developed as a result of shoot moth attack. Adjacent Austrian pine trees, however, are almost unaffected. Although the shoot moth population indexes of Scotch and Austrian pine in the study plantations did not prove to be statistically different, the writers' impression from a number of other mixed Scotch and Austrian pine plantings is that Austrian tends to be the less susceptible. White pine growing better than that in the study plantations has been noted to be seriously damaged by the shoot moth when situated close to red pine.

This study gives further support to the idea that in areas where the European pine shoot moth is a perennial problem, damage in pine stands can be reduced by the proper selection of pine species for planting. Still other pine species or hybrids not yet investigated may eventually be shown to be low in susceptibility to attack.

Nature of Susceptibility

Relative susceptibility of pines to the shoot moth may be due to (1) equal egg laying on all trees followed by differential survival on some trees, (2) differential egg laying followed by equal survival, or (3) a combination of these two possibilities. Available evidence on this problem favors the combination of possibilities.

From the standpoint of foliage quantity, the number of eggs laid on adjacent red and Scotch pine trees in one of the study areas indicated differential egg laying. The mean number of eggs per tree was 39 on red pine (9 trees) and 45 on Scotch pine (4 trees). These figures are almost the same when considered alone, but when they are related to foliage quantities of the two species by dividing number of eggs by number of shoots, then a sharp difference comes out. The resulting egg-shoot ratio of 0.7 on the red pine was more than 3 times larger than the 0.2 on the Scotch.

In the foregoing area, differential shoot moth survival was evident by the end of the 1958 growing season, when the shoot moth larvae were about half grown. Survival of the larvae up to this time on the red pine (9 trees) was over 60 percent, but on the Scotch (4 trees), it was under 20 percent. The Scotch pine trees themselves appeared to somehow increase shoot moth mortality. In England, Brooks and Brown (*1*) had inferred that differential survival accounted for differences in injury levels between Scotch and Corsican pine which had earlier contained about equal numbers of young larvae.

Summary and Conclusions

1. Observations were made on eight species of pine to determine their relative susceptibility to European pine shoot moth attack in Michigan.

2. The method used was to compare ratios of number of insects to number of shoots found on each pine species near the end of the shoot moth generation.

3. On the basis of these ratios, Virginia, pitch, jack, and eastern white pines were rated as having low susceptibility, their insect-shoot ratios averaging less than 0.002. Ponderosa, Austrian, and Scotch pines were rated as medium in susceptibility with mean insect-shoot ratios between 0.03 and 0.07. Red pine was rated as high in susceptibility; its insect-shoot ratio being 0.2, the highest of the study.

4. In Lower Michigan, and perhaps in other areas where the shoot moth is a severe pest of red pine, damage could probably be reduced by the planting of otherwise suitable species from the low and medium susceptibility groups defined by this study.

Literature Cited

1. BROOKS, C. C., and J. M. B. BROWN. 1936. Studies on the pine shoot moth (*Evetria buoliana* Schiff.) (Great Britain) Forestry Comm. Bull. 16: 1-46.
2. DUNCAN, D. B. 1955. Multiple range and multiple F tests. Biometrics 11: 1-42.
3. HOLST, M., and C. HEIMBERGER. 1955. The breeding of hard pine types resistant to the European pine shoot moth. (*Rhyacionia buoliana* Schiff.) Forestry Chron. 31: 162-169.
4. LITTLE, E. L. 1953. Check list of native and naturalized trees of the United States, including Alaska. U.S. Dept. Agric., Agric. Handbook 41, 472 pp.
5. ZOCCHI, R. 1952. Contributi alla conoscenza degli insetti delle piante forestali. II. Note biologiche sull 'Evetria buoliana Schiff. (Lepidoptera Tortricidae). Redia 37: 345-369.

Site Preparation for Reforestation, Using a D-7 Crawler Tractor with Angle Dozer

Bruce A. Shaner

DYNAMIC reforestation programs in the Northwest during recent years have put much forest land back into production. Private ownerships, leading the way in this land rehabilitation, found that on some sites competing vegetation precluded natural and artificial reforestation. Some manner of site treatment was needed prior to seeding or planting on these problem areas.

By utilizing the mobile power of big crawler type tractors and equipping them with special land clearing blades, economical site preparation was, and is, being accomplished over many thousands of acres in the Pacific Northwest. Following is an example of how one company, Oregon Pulp and Paper Company, adapted a variation of this "land scarification" to fit its own needs.

The sites prepared occurred mostly on low elevation (500-2,000 feet) lands on the east side of the Coast Range of western Oregon. Sod and brush competition effectively curtailed reforestation; scalps accomplished by hand planting tools were also ineffective. The ground was too rough for machine planting. Searching for an answer to this problem, company foresters visited Weyerhaeuser Timber Company's Clemens Tree Farm at Cosmopolis, Washington, where extensive land scarification was being done with big crawler type tractors using brush clearing blades. Based on observations of results there, in the fall of 1957 it was decided to use machine scarification in an attempt to solve the sod and brush competition problem (Figs. 1 and 2).

Since a large amount of 2-0 Douglas-fir stock was already bought for the season, it was decided to scalp the sod sufficiently for hand planting, but not 100 percent scarified as Weyerhaeuser Company had done for aerial seeding.

THE AUTHOR at the time this article was written was with the Forestry Division, Oregon Pulp & Paper Co., Salem, Ore., and is now with the Timber Department of National Plywood Corp., Roseburg, Ore.

Method of Operation

A D-7 caterpillar tractor with an angle dozer was used. The angle dozer was tilted as far as possible to the heel side of the blade and the blade kept fully lowered so as to make a furrow as deep as possible. (A full length dozer cable was used at all times.) The bottom of the furrow usually was 6 to 12 inches below the ground level and was well below the sod roots' lower level. The furrows were usually 11 feet from center to center. (The trees were handplanted 6 feet apart in the furrows with a resulting spacing of 6 x 11 feet.) When an area was started the first pass went entirely around the area to delineate it and then the succeeding passes went around and around in toward the center, much like a farmer plowing a field. However, when the debris was heavy it was sometimes found speedier to make parallel passes rather than circular passes, as parallel passes tended to straighten the old logs so you only

FIG. 1.—Prepared reforestation site after scarifying with a D-7 crawler tractor and angle dozer. It is 11 feet from furrow to furrow.

FIG. 2.—Typical soddy south slope on eastern side of Oregon Coast Range. The darker area on the hilltop is scarified, the lighter areas on the bottom half of the hill are not scarified, being too steep.

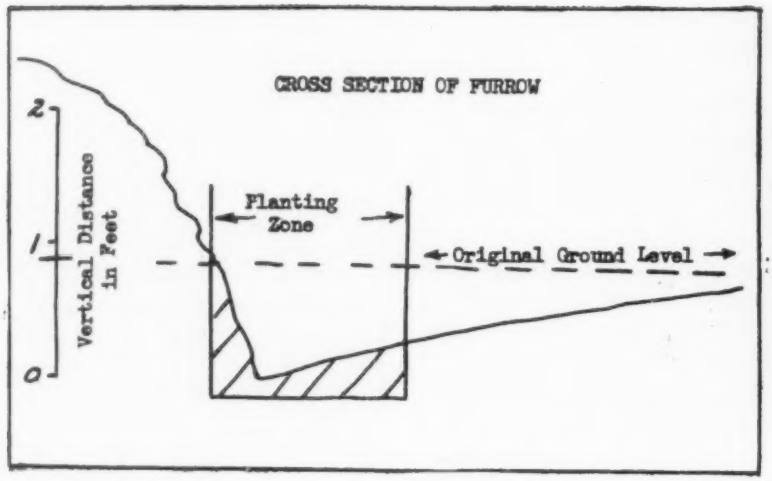

FIG. 3.—Cross section of furrow, showing planting zone.

hit them once. Steeper contours necessitated parallel passes, also.

All patches of reproduction were plowed around by the catskinner, who could see them quite well. Fern patches were not plowed because in this area trees can be successfully grown under fern cover. Slopes of 30 to 40 percent and higher were not usually worked due to their being too steep for economical operation.

Miscellaneous Notes

The scarified brush areas were suitable for either hand planting or seeding and so were some of the scarified sod areas; however, the scarified sod areas on south slopes were of doubtful value as seedbeds for seeding although suitable for hand planting.

The D-7 tractor with angle dozer attached can be legally carried on highways with the company "low boy." This makes for economical and quick moves where the areas to be worked are some distance apart.

Planting the furrows was delayed until winter rains had stabilized soil movement (see Fig. 3). Furrowing generally followed the contour and erosion was not excessive.

Time and Cost

There were 160 acres scarified at an average cost of $11.50 per acre. The costs include those of labor, equipment and supervision.

Approximately 1½ acres of sod were plowed per machine hour of scarification operation and about 1 acre of heavy bottom land brush was scarified per hour. An average of 9 acres per day was scarified; this includes the time spent for equipment moving, transportation and maintenance.

Summary

The furrowing of sodded and brush lands by D-7 caterpillar with angle dozer is a workable and economical method of site preparation for reforestation in some particular areas. Results indicate furrowing effectively knocks back sod and most other competition for at least 2 years in the furrow, giving the planted seedling an opportunity to become well established.

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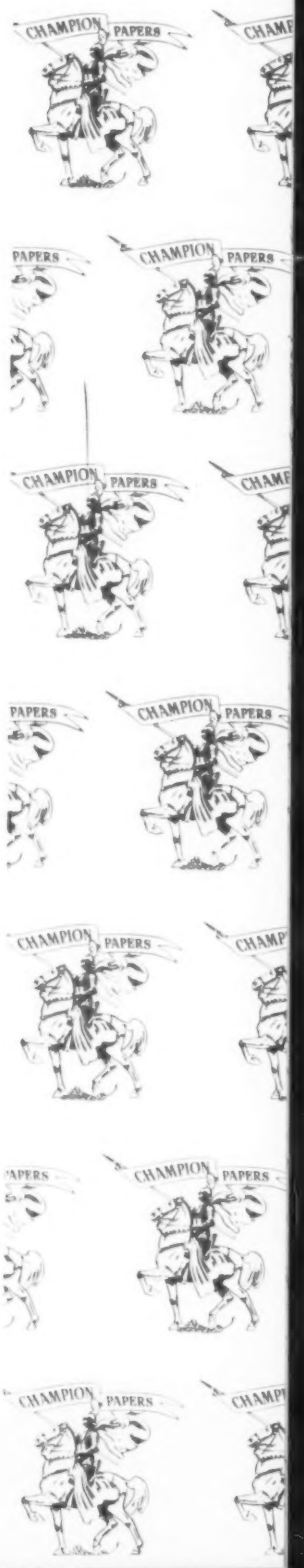

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Distribution of Dwarfmistletoes in Relation to Topography on the Mescalero Apache Reservation, New Mexico

Frank G. Hawksworth

THE DWARFMISTLETOES (*Arceuthobium* spp.) are widespread in the Southwest and are important parasites of forest trees in this area. *Arceuthobium vaginatum* f. *cryptopodum* (Engelm.) Gill, which is specific to the Rocky Mountain form of ponderosa pine, *Pinus ponderosa* Laws., is the most damaging from an economic standpoint as its host makes up over 80 percent of the commercial sawtimber in Arizona and New Mexico. *Arceuthobium douglasii* Engelm., the species found on Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, is also of considerable importance, although the tree is a secondary species in this region.

This article deals with the relationships between topography and frequency of *Arceuthobium vaginatum* f. *cryptopodum* (hereafter abbreviated *A. vaginatum*) and *A. douglasii* on the Mescalero Apache Reservation, New Mexico. This reservation, which is located in Otero County in the south central part of the state, includes a commercial forest area of about 215,000 acres. Ponderosa pine makes up about one-half the total gross volume, Douglas-fir about one-fourth, and the remaining volume is made up of white fir (*Abies concolor* Gord. and Glend.), limber pine (*Pinus flexilis* var. *reflexa* Engelm.), Engelmann spruce (*Picea engelmannii* Parry), and blue spruce (*P. pungens* Engelm.). Dwarfmistletoe was not seen on these last four species on the reservation, although they are attacked in other parts of the Southwest (*2*).

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The research reported was conducted from the Station's Forest Disease Laboratory at Albuquerque, N. Mex.

Literature Review

The local dispersal of dwarfmistletoes is accomplished primarily by explosive fruits that expel the seeds 10 to 30 feet (*2*). The rate of spread of these parasites through a stand is relatively slow and approximates 1 to 2 feet per year (*4*). Long distance spread is presumably attributable to birds, although no precise information on this subject is available. The amount of infection in diseased stands is typically variable, and areas of heavy infection frequently occur adjacent to dwarfmistletoe-free areas.

Stand history, particularly the occurrence of fire, often provides an explanation for the discontinuous distribution of dwarfmistletoe over large areas (*3*). Severe fires that completely kill the forest play an important role in reducing the parasite, as spread of the disease back into burned-over areas is much slower than the return of tree species.

Logging also influences the distribution of dwarfmistletoes. Heavy cutting, particularly in mature ponderosa pine stands which have little or no understory, may tend to decrease the incidence of the parasite, but partial cutting generally stimulates dwarfmistletoe in the residual trees (*2*).

Environmental or topographic features also exert a considerable influence on the distribution of these parasites, but little quantitative information has been published on this subject. MacDougal (*8*) reported that *A. vaginatum* f. *cryptopodum* on ponderosa pine in northern Arizona was most severe along the rims of canyons or along the brows of hills or margins of mesas. He surmised that this was due to more favorable germination conditions as a result of the warm air rising from the valleys and lowering the dew point and raising the relative humidity at these places. Somewhat later, Korstian and Long (*7*) confirmed that this species is most common on ridges and added that infection is heavy on slopes of southern exposure and that the parasite appeared to be most damaging near the lower limit of the ponderosa pine type. Palmer (*9*) stated that in the Davis Mountains of west Texas *A. vaginatum* was apparently commonest at the lowest altitudes at which ponderosa pine is found. Gill (*3*) reported that this species is "most abundant on ridges . . . common on slopes, less common on bottoms and extremely rare on submarginal sites outside the commercial range of ponderosa pine." Dowding (*1*) found that *A. americanum* Nutt. ex Engelm. on *Pinus banksiana* in Alberta was most common on dry hill summits. Recently, Roth (*10*) has indicated that infection of ponderosa pine by *A. campylopodum* f. *campylopodum* (Engelm.) Gill in one locality in Oregon was most severe on northwestern and least in northeastern exposures. Roth also reported that the incidence of this parasite increased markedly with increases in steepness of slopes. According to Hawksworth (*5*) the frequency of *A. americanum* on *Pinus contorta* in Colorado and Wyoming was about twice as high on ridges and slopes as on bottoms.

The slow rate of invasion of dwarfmistletoes into areas where the forest has been destroyed by severe fires or logging tends to mask relationships between incidence of the parasite and topography. In spite of the discontinuous occurrence of dwarfmistletoes, correlations between these parasites and topography are found. This sug-

gests that environmental features exert a considerable influence on their distribution.

Methods

The data presented here were obtained in a dwarfmistletoe-damage-appraisal survey conducted on the Mescalero Apache Reservation in 1952-1953 (*6*). In brief, the survey methods used were as follows: one-tenth acre, circular plots were located at random intervals (6 per linear mile) along parallel lines run one-half mile apart through the 334 square miles of commercial forest on the reservation. Detailed information on the composition, size classes, and degrees of infection on each plot was recorded, but this paper deals only with the frequency (presence or absence) of dwarfmistletoe on a plot basis. The frequency data were used because of the difficulty in uniformly classifying abundance of dwarfmistletoe in areas where the size classes and number of trees varied considerably from plot to plot. Also, by use of the frequency basis, data from virgin and cutover areas could be combined since it is unlikely that logging on the reservation has appreciably altered the frequency of dwarfmistletoe, but logging has affected its abundance. A reduction of the occurrence of these parasites on a plot basis is not to be expected here, for most of the stands are 2-aged and the understory trees have not been harvested. Although logging generally intensifies dwarfmistletoe in the residual trees, this should have little effect on the frequency of the parasite in this area since most of the logging has been relatively recent (less than 20 percent of the area had been cutover for more than 20 years and none for more than 30 years).

Although both dwarfmistletoes were found on some plots, the analyses in this paper are based on *A. vaginatum* on plots where ponderosa pine was the predominant species and of *A. douglasii* where Douglas-fir predominated.

Results

A total of 3,661 plots were established. Ponderosa pine was the predominant species on 67.3 percent of the plots and Douglas-fir on 26.7 percent. White fir and limber pine were the predominant species on the remaining 6.0 percent of the plots. Dwarfmistletoe was found on 53 percent of the ponderosa pine plots and on 33 percent of the plots in the Douglas-fir type.

Dwarfmistletoe in relation to topographic position. — The observed affinity of *A. vaginatum* for ridges as has been noted (*3, 7, 8*) was confirmed in this study (Table 1). The frequency of this parasite was nearly twice as high on ridges as on bottoms. The proportion of the plots in each topographic position is also given in Table 1. This illustrates the commonly overlooked fact that, although ridges show a high frequency of *A. vaginatum*, they constitute a relatively small proportion of a forest area (6 percent on the Mescalero Reservation). Dwarfmistletoe was found on 53 percent of the slope plots, which comprised 87 percent of the ponderosa pine areas surveyed. The differences in *A. vaginatum* frequency in the 3 topographic positions are highly significant[1] as determined by Chi-square tests. However, the differences for *A. douglasii* in the 3 topographic positions are not significant.

Dwarfmistletoe in relation to steepness of slope.—The frequency of *A. vaginatum* decreased slightly with increases in steepness of slope (Table 2). This is just the opposite of Roth's (*10*) findings on a related dwarfmistletoe on ponderosa pine in the Northwest. Some of the difference between the northwestern and southwestern species on ponderosa pine is probably due to variations in sampling technique, as Roth's data were based on intensive studies on a 640-acre area while those in Table 2 are based on 2,464 plots distributed throughout 215,000 acres. Chi-square tests of the data in Table 2 indicate the difference between frequencies on gentle and moderate slopes is not significant, but on steep slopes frequencies are significantly different from those on gentle and moderate slopes.

[1]In this paper, if the probability is only 5 percent that a greater difference would occur by chance it is termed "significant," and "highly significant" if the probability is only 1 percent. If the probability is greater than 5 percent the difference is considered not significant.

TABLE 1.—FREQUENCY OF *Arceuthobium vaginatum* AND *A. douglasii* IN RELATION TO TOPOGRAPHIC POSITION OF PLOTS

Topographic position	Plots in ponderosa pine type			Plots in Douglas-fir type		
	Total		Frequency of *A. vaginatum*	Total		Frequency of *A. douglasii*
	Basis	Proportion of total		Basis	Proportion of total	
	Number	*Percent*	*Percent*	*Number*	*Percent*	*Percent*
Bottom	167	7	37	39	4	33
Slope	2,146	87	53	897	92	34
Ridge	151	6	67	43	4	28
Total or average	2,464	100	53	979	100	33

TABLE 2.—FREQUENCY OF *A. vaginatum* AND *A. douglasii* IN RELATION TO STEEPNESS OF SLOPE (SLOPE TYPE PLOTS ONLY)

Steepness of slope	Ponderosa pine plots		Douglas-fir plots	
	Basis	Frequency of *A. vaginatum*	Basis	Frequency of *A. douglasii*
	Number	*Percent*	*Number*	*Percent*
Gentle (less than 10 percent	1,088	57	332	27
Moderate (10 to 30 percent)	622	53	279	36
Steep (over 30 percent)	436	45	286	39
Total or average	2,146	53	897	33

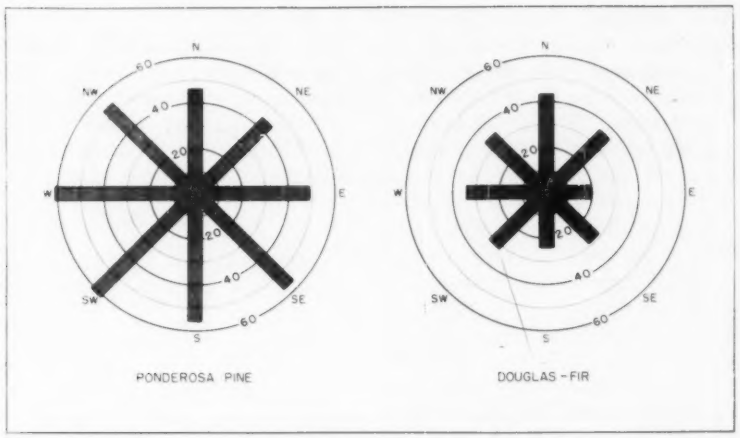

FIG. 1.—Percent of plots with dwarfmistletoe in the eight major aspects in ponderosa pine and Douglas-fir (slope plots only). Basis: 2,118 ponderosa pine and 892 Douglas-fir plots.

The trend of *A. douglasii* on the Mescalero was just the reverse of that of *A. vaginatum*, that is, the frequency of *A. douglasii* was higher on the steeper slopes (Table 2). Chi-square tests suggest that the difference between moderate and steep slopes is not significant, but that gentle slopes are significantly different from moderate and steep slopes.

Dwarfmistletoe in relation to aspect.—The survey results indicate that *A. vaginatum* on slope sites on the Mescalero has its highest frequency on southwestern and western exposures and lowest on northeastern and northern aspects (Fig. 1). The frequency of *A. douglasii* is highest on north slopes and is lowest on slopes of eastern, southeastern, and southern exposures. On slopes of north exposure the frequency of *A. vaginatum* and *A. douglasii* is about the same, but there are marked differences on all other aspects.

The tendency for *A. vaginatum* to be less common on the steeper slopes was fairly consistent in each of the 8 major aspects. The frequency of this dwarfmistletoe was highest on gentle, western slopes (74 percent of the plots infected) and lowest on steep, northeastern slopes (33 percent of the plots infected).

Dwarfmistletoe in relation to altitude.— The relationship between *A. vaginatum* and altitude (Fig. 2) indicates that this dwarfmistletoe has its highest frequency in the medial elevations of the ponderosa pine type. These data are probably typical for the Southwest but are in marked contrast to Korstian and Long's (7) observation that *A. vaginatum* in this region is most abundant near the lower limit of the type. Fig. 2, which is based on the slope type plots only, shows that 30 percent of the ponderosa pine type plots were at 7,800 feet altitude. Here the frequency of

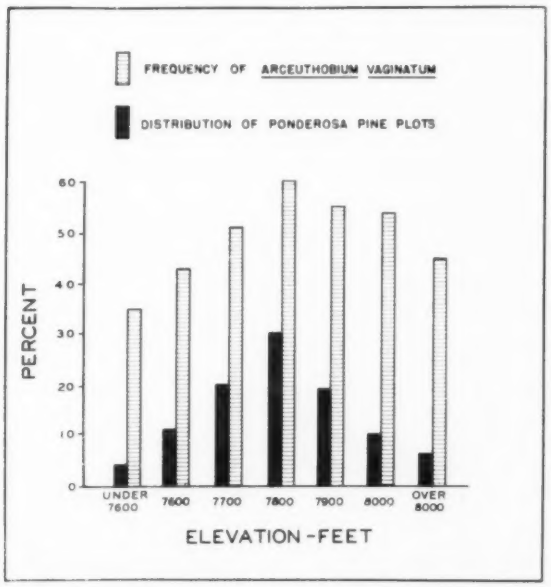

FIG. 2.—Relationship between the elevation of the sample plot and frequency of *A. vaginatum*. The black bars indicate the percent of the sample in each elevation class while the cross-hatched bars show the frequency of dwarfmistletoe in each elevation class. Basis: 2,146 slope type plots.

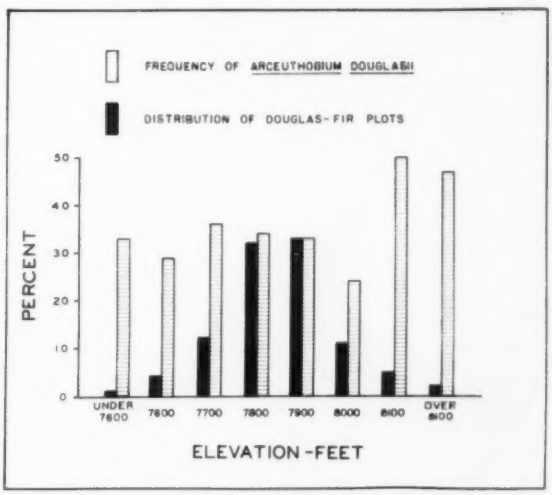

FIG. 3.—Relationship between the elevation of the sample plot and frequency of *A. douglasii*. The black bars indicate the percent of the sample in each elevation class while the cross-hatched bars show the frequency of dwarfmistletoe in each elevation class. Basis: 897 slope type plots

A. vaginatum was highest (60 percent of the plots with dwarfmistletoe). The decrease in infection near the lower limits of the ponderosa pine type is very marked in this locality. To the east of the commercial ponderosa pine forests on the Mescalero lies an extensive area covered by low-elevation, marginal ponderosa pine. General scouting of the area indicated that *A. vaginatum* is absent or exceedingly rare in these stands.

There were no consistent differences in frequency of *A. douglasii* at various elevations in the Douglas-fir type (Fig. 3). The results show a higher dwarfmistletoe frequency above 8,000 feet, but the small basis for these classes (61 plots) and the low frequency in the 8,000 foot class suggest that the differences are due to inadequate sampling.

Discussion

The factors governing the distribution of dwarfmistletoes on various topographic sites as discussed in this paper are largely unknown. In the case of ponderosa pine dwarfmistletoe (*A. vaginatum*), with its high frequency on ridge sites and on south and southwest slopes, one is tempted to hypothesize a relationship between occurrence of dwarfmistletoe and unfavorableness of the site. However, since the altitudinal data (Fig. 2) show that the parasite is most common in the medial host range and is exceedingly rare or absent in ponderosa pine at low elevations, this indicates that factors other than site quality are involved in its distribution. The factors influencing the distribution of dwarfmistletoes will probably not be known until detailed studies are made of the microclimate in various sites and of its effects on both the host and the parasite.

Summary

The results of a survey of 215,000 acres of commercial forest on the Mescalero Apache Reservation, New Mexico, which are based on the frequency of ponderosa pine dwarfmistletoe (*Arceuthobium vaginatum* f. *cryptopodum*) on 2,464 ponderosa pine type plots and on Douglas-fir dwarfmistletoe (*A. douglasii*) on 979 plots of that type, showed that:

1. The frequency of *A. vaginatum* is highest on ridges, less on slopes, and least in bottoms. *A. douglasii* showed no significant differences in the 3 slope positions.

The following relationships pertain to the slope-type plots, which constituted about 88 percent of the area.

2. *A. vaginatum* is most common on southwestern and western aspects, while *A. douglasii* occurs most commonly on north and northeastern exposures.

3. *A. vaginatum* decreases slightly with increases in steepness of slope, but the reverse is true for *A. douglasii*.

4. The frequency of *A. vaginatum* was highest at medial elevations in the ponderosa pine type, but there was no consistent relationship between *A. douglasii* and elevation of the sample plot.

Literature Cited

1. DOWDING, ELEANOR S. 1929. The vegetation of Alberta III. The sandhill areas of Central Alberta with particular reference to the ecology of *Arceuthobium americanum* Nutt. Jour. Ecol. 17:82-105.
2. GILL, L. S. 1935. *Arceuthobium* in the United States. Trans. Conn. Acad. Arts and Sci. 32:111-245.
3. ————. 1954. Dwarfmistletoe of ponderosa pine in the Southwest. Rocky Mtn. Forest and Range Expt. Sta., Station Paper 14, 9 pp.
4. HAWKSWORTH, FRANK G. 1958. Rate of spread and intensification of dwarfmistletoe in young lodgepole pine stands. Jour. Forestry 56:404-407.
5. ————. 1958. Survey of lodgepole pine dwarfmistletoe on the Roosevelt, Medicine Bow, and Bighorn National Forests. Rocky Mtn. Forest and Range Expt. Sta., Station Paper 35, 13 pp.
6. ————, and ARTHUR A. LUSHER. 1956. Dwarfmistletoe survey and control on the Mescalero Apache Reservation, New Mexico. Jour. Forestry 54:384-390.
7. KORSTIAN, CLARENCE F., and W. H. LONG. 1922. The western yellow pine mistletoe. U. S. Dept. Agric. Bul. 1112, 35 pp.
8. MACDOUGAL, D. T. 1899. Seed dissemination and distribution of *Razoumofskya robusta* (Engelm.) Kuntze. Minn. Bot. Studies 2:169-173.
9. PALMER, E. J. 1929. The ligneous flora of the Davis Mountains, Texas. Jour. Arnold Arb. 10:8-45.
10. ROTH, LEWIS F. 1954. Distribution, spread, and intensity of dwarfmistletoe on ponderosa pine. Phytopath. 44:504

Notes and Observations

Selecting Sound Acorns For Planting Bottomland Hardwood Sites

Nut or acorn weevils such as *Curculio baculi, Curculio longidens, Curculio pardalis,* and *Conotrachelus posticatus,* and the filbert worm (*Melissopus latiferreanus*) seriously limit the viability of acorns. Flotation in water is a commonly accepted method of separating weeviled from sound acorns before planting (sound acorns usually sink). Although more time consuming, separation by visual inspection is better for some oak species. Tests showed that hand-sorted acorns of swamp chestnut oak (*Quercus michauxii* Nutt.) produced two or three times more seedlings than an equal number separated by flotation. Likewise, hand-selected acorns of Shumard oak (*Q. shumardii* Buckl.) and cherrybark oak (*Q. falcata* var. *pagodaefolia* Ell.) were mostly sound.

The presence of weevils in a swamp chestnut oak acorn is revealed by one or more blemishes on the shell. A small dark spot on the shell marks an opening made by the egg-laying beetle, and if weevils are not already feeding on the acorn, they soon will be. Conspicuous dark spots or splotches indicate more advanced weevil activity. Accordingly, it is easy to separate good acorns from bad ones and collectors could be trained to leave most of the weeviled acorns in the woods.

The reliability of this visual selection method for chestnut oak has been established by a number of small tests. In one test, several

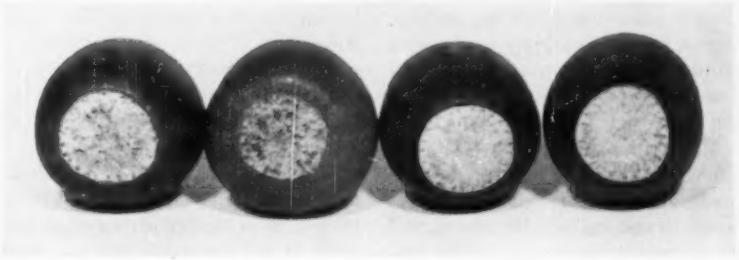

FIG. 1.—Shumard oak acorns. Those with light colored cup scar (2 on right) are sound, and those with dull coloration (2 on left) show evidence of weeviling or rot.

lots of 50 acorns each were sown in seed flats in a greenhouse. In this controlled environment, germination of the visually selected acorns averaged 92 percent compared to 41 percent for those sorted by flotation. In another test, 200 acorns in each category were field sown in areas suitable for growing bottomland hardwoods. These areas were second bottoms or terraces paralleling the course of a small stream. At the end of the first growing season, the acorns sorted by flotation averaged only 25 percent survival as compared to 82 percent for the hand-sorted acorns.

Shell blemishes are not conspicuous on the smaller Shumard and cherrybark oak acorns and weeviled acorns are more difficult to detect by the foregoing technique. However, the soundness of Shumard oak and cherrybark oak acorns can be judged with certainty by the color of the basal or cup scar. If the circular scar is a light tan, the acorn is sound; if a dull brown, the acorn is defective (Fig. 1). These color relationships are easily established in actual practice. Cutting tests showed that 90 percent or more of the acorns selected as sound were not weeviled. All of the acorns with discolored basal scars were weeviled or otherwise damaged. As Shumard and cherrybark are red oaks, it may be that this method has general application to that group of oaks. On the other hand, it does not work too well with swamp chestnut oak, which belongs to the white oak group.

The success of visual selection, as evidenced by the high germination percentages, makes further weevil treatment unnecessary. If the flotation method is used, the selected acorns should be immersed in water at 120°F. for 30 to 45 minutes, or fumigated in a tight container for 4 hours with one ounce of methyl bromide per 25 cubic feet to kill the weevils. The elimination of this step will tend to offset the higher cost of visual selection when relatively small quantities of acorns are handled.

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An All-Purpose Cruiser Stick

This note describes the construction of a modified Biltmore stick that may be used for (1) point-sampling, (2) determining diameters and merchantable heights of standing trees, and (3) log scaling. It can be inexpensively made with hand tools, an engineer's scale, and a set of letter and number stamping dies.

Point-sampling, or variable-plot timber cruising, has gained wide acceptance as a result of applications developed by Grosenbaugh.[1] Stick-type gauges originally proposed for establishing sighting angles have been largely replaced by wedge prisms, following recommendations by Bruce.[2] Stick gauges are quite satisfactory for occasional use, however, and their utility can be increased by the addition of appropriate scales from Biltmore sticks and log rules. D.b.h. and hypsometer graduations may be calculated to accomodate the arm reach of the individual, and the "sight" used for point-sampling performs a dual purpose by serving as an end hook for scaling logs.

A straight-grained piece of seasoned hardwood (such as red oak, beech, or maple) should be surfaced to a finished size of about ½ by 1 by 33 inches. One edge should be beveled as shown in Figure 1.

Metal sight.—A sight exactly 1-inch wide must be affixed to the end of the 33-inch base to establish a viewing angle of 104.18 minutes (basal area factor of 10 square feet per acre). A short section of L-shaped "do-it-yourself" aluminum serves for this purpose. With the wide face ("A") of the stick toward the observer, the sight is mounted in a slot sawed in the left-hand end of the stick. This slot should be located so that the sight extends over the face of the stick about 3/8 of an inch (Fig. 1). A peepsight at the opposite end of the stick is not essential, but one can be easily improvised from an ordinary window shade bracket (the type with a circular hole in the center).

D.b.h. scale.—These graduations, in 2-inch diameter classes, are placed on side "A" of the stick, reading from left to right. Graduation intervals for persons with arm reaches of 23 to 27 inches may be read directly from a published table.[3] When the common 25-inch distance from eye to tree is used, the stick length will accomodate d.b.h. readings slightly beyond 60 inches. After location with an engineer's scale, graduations should be penciled on the stick with the aid of a small try square. Permanent markings can be stamped with a double beveled cold chisel or sharpened screwdriver, and numbers placed below with stamping dies.

Hypsometer scales.—These are a matter of individual choice, but it is usually desirable to have one scale for pulpwood bolt lengths and another for log intervals. With the stick in a vertical position, both scales should read upward from the "sight" end, with the pulpwood scale on side "B" and the sawlog scale on side "C." Using the Merritt hypsometer principle, graduation intervals are uniform in length, and may be calculated by this relationship:

$$\text{Height graduation interval (in inches)} = \frac{\text{Arm reach (in.)} \times \text{log length (ft.)}}{\text{Distance from tree (ft.)}}$$

With a 25-inch arm reach, log lengths of 16.3 feet, and 1-chain distance from observer to tree, the graduation interval on the stick would be $25 \times 16.3 \div 66$, or 6.17 inches per log. The formula can also be applied to determine graduations for desired pulpwood lengths, as 4, 5, or 8 feet.

Log scales.—These graduations are stamped on the beveled edge of the stick (side "D"), reading *right to left* from the "sight" end with increasing log diameters. In this way, the sight is used as an end hook for scaling. By using stamping dies with small numerals, rules for two or more log lengths can be placed above one another on the bevel, covering a range of log diameters from about 6 to 30 inches.[4]

After all graduations and numbers have been stamped, they

[1]Grosenbaugh, L. R. Plotless timber estimates—new, fast, easy. Jour. Forestry 50:32-37. 1952.

[2]Bruce, David. A new way to look at trees. Jour. Forestry 53:163-168. 1955.

[3]Chapman, H. H. and W. H. Meyer. Forest mensuration. McGraw-Hill Book Co., New York. 1949.

[4]Munns, E. N., Theresa G. Hoerner, and V. A. Clements. Converting factors and tables of equivalents used in forestry. U. S. Dept. Agric. Misc. Pub. 225, 48 pp. Revised 1949.

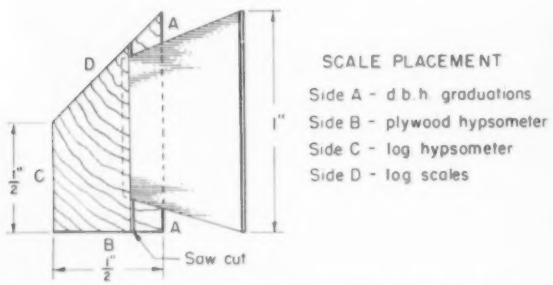

FIG. 1.—End view of cruiser stick showing 1-inch metal sight (partially shaded area).

FIG. 2.—Use of cruiser stick for point-sampling.

should be darkened by retracing with a 4H or 5H pencil. Drawing ink should not be used as it tends to "run" with the grain of the wood, producing ragged outlines. Excessive pencil markings can be removed by sanding, and the stick finished with a coat of clear lacquer or spar varnish.

The cruiser stick can be checked for point- sampling by sighting on a target 1 foot wide from a distance of 33 feet. At this point, target width should exactly coincide with the sight width. Figure 2 illustrates field use of the instrument for point-sampling.

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Infection Experiments with Septogloeum gillii, a Fungus Parasitic on Dwarfmistletoe

Dwarfmistletoe (*Arceuthobium americanum* Nutt. ex Engelm.) is widespread and causes heavy losses in lodgepole pine (*Pinus contorta* Dougl.) over the range of this tree in the Rocky Mountain region (*4*), and is also common in the Intermountain region. Probably the most important pathological problem on this host today is reduction of damage caused by *A. americanum*. Any possible means of reducing losses caused by this parasite should therefore be given consideration because the only practical control now known is through proper silvicultural management of affected stands.

In 1946 Ellis (*1*) described *Septogloeum gillii* Ell., a parasitic fungus found on a number of species of dwarfmistletoe. According to him, *S. gillii* is evidently responsible for considerable control of dwarfmistletoe under natural conditions for, in some localities, the disease apparently greatly reduced the reproduction and local spread of its host. Ellis, however, considered that further studies were necessary to determine whether introduction of the fungus into new areas for biological control would be practical.

When Ellis (*1*) described *S. gillii* in 1946, *A. americanum* was not known to be a host of the fungus. Also, its known range then was the three Pacific Coast States and Arizona, New Mexico, and southern Utah. With the hope that the parasitic fungus could be introduced into other areas and thus be employed as a biological control agent, the writer started a series of infection experiments with it in early July 1952. Very shortly thereafter *A. americanum* was reported as a natural host of *S. gillii* (*2*). This discovery had been made in 1948 in Montana. The known range of the fungus was further extended late in 1952 when it was found on *A. americanum* in Wyoming (*3*). The present paper reports the results of experiments with the fungus in northern Utah and eastern Idaho.

Description of the Disease on Dwarfmistletoe

Septogloeum gillii is a parasitic, imperfect fungus that causes an anthracnose of dwarfmistletoe and is responsible for the premature death of large numbers of the plant's shoots (*1*). Infections also occur sometimes on the fruits. The early stage of the disease is characterized by production of small, yellowish-white lesions along the stem of the dwarfmistletoe plant. These gradually enlarge, often coalesce, and eventually erupt irregularly through the epidermal layer exposing conspicuous white spore masses. Lesions most commonly originate at or near the nodes, but may also occur on any part of the stem, including its base.

Large numbers of dead dwarfmistletoe shoots bearing ruptured lesions provide the best field evidence of presence of the disease. Pistillate plants are attacked more frequently than staminate ones (*1*).

Infection Experiments

Inoculum was collected on the Kaibab Plateau in northern Arizona July 9, 1952. The host of the fungus was *A. campylopodum* forma *divaricatum* (Engelm.) Gill on pinyon (*P. edulis* Engelm.). Infected dwarfmistletoe plants were common, and a large number of shoots bearing fruiting bodies of the fungus was readily obtained.

The experiments with the fungus were conducted on the Cache National Forest in northern Utah at elevations averaging 7,000 feet, and on the Targhee National Forest in eastern Idaho at elevations averaging 6,600 feet. These areas were selected because Ellis (*1*) had found the disease at elevations between 6,500 and 9,500 feet where prevailing temperatures are rather low. Minimum, optimum, and maximum temperatures for growth of the fungus in culture were about 34°, 63°, and 73° F., respectively, and indicated that it is favored by a cool environment (*1*). The plots were established in stands of lodgepole pine heavily infected with *A. americanum*. Young diseased trees averaging about 2¾ inches d.b.h. were selected for the tests.

Ellis (*1*) had found that the fungus is not a wound parasite and successfully infected dwarfmistletoe plants with it by merely applying spore suspensions. Accordingly, just prior to use, the inoculum was prepared by placing dwarfmistletoe shoots bearing fruiting bodies in a small glass jar containing distilled water. Vigorous shaking of the jar produced a spore suspension so rich that a light milky color was imparted to the water. A somewhat diluted form of the suspension, used in a small hand-type sprayer, was then applied to dwarfmistletoe plants on the plots.

Inoculations on the Cache Forest were made July 15, 1952, by spraying all dwarfmistletoe plants within reach on 10 lodgepole pines with a spore suspension of the fungus. On August 4 three additional test plots were established in the same manner on the Targhee Forest with 10, 15, and 15 pines, respectively, per plot. The number of dwarfmistletoe plants inoculated was not determined, but ranged from 4 to a maximum of about 30 per tree.

Warm, dry weather prevailed for several weeks following the inoculations on the Cache Forest. On the Targhee Forest the day of the inoculations was cool and the sky partly overcast. Late in the afternoon a rather heavy thunderstorm occurred.

Results and Discussion

The incubation period of the fungus on dwarfmistletoe plants is usually about 60 days or more (*1*). On September 24, 1952, an examination of dwarfmistletoe plants inoculated July 15 on the Cache Forest revealed that *S. gillii* was just appearing. The lesions were very small—only about the size of a pinhead. There was no opportunity that fall to examine the Targhee plots.

On August 13, 1953, *S. gillii* was found on 96 *A. americanum* plants in 34 of the total of 40 lodgepole pines on the three Targhee plots. On the Cache Forest the fungus was present August 26 on 25 dwarfmistletoe plants in 8 of the 10 trees. In 1954 *S. gillii* was generally scarce on all plots, and by 1955 it had disappeared from the Cache plot and was found on only 4 plants on the Targhee plots. In 1956 the fungus was not found on any of the plots.

Ellis (*1*) found that the spores of *S. gillii* are spread locally mainly by the splattering and blowing of rain water. In the fall of 1948 Gill (*2*) observed that *A. americanum* on lodgepole pine had suffered heavy mortality by the fungus at several locations in the Lewis and Clark National Forest in Montana. The spring and summer of 1948 there were exceedingly wet, and Gill thought this condition might account for the development of the fungus to epidemic proportions. He examined these infected areas in 1952 and found *S. gillii* to be rather rare at that time.

In the Intermountain region the summers of 1953 and 1954 were relatively dry. It is believed that the parasite finally died out on the four experimental plots following its successful introduction because of a lack of moisture (rains) necessary for spore dissemination and infection of the dwarfmistletoe host. Disappearance of the fungus on the experimental plots suggests that it would have doubtful utility in the biological control of the dwarfmistletoe in this region.

Literature Cited

1. ELLIS, DON E. 1946. Anthracnose of dwarfmistletoe caused by a new species of *Septogloeum*. Elisha Mitchell Sci. Soc. Jour., 62: 25-50.
2. GILL, L. S. 1952. A new host for *Septogloeum gillii*. Plant Dis. Rptr. 36: 300.
3. ————. 1952. Letter dated November 13.
4. ————. 1957. Dwarfmistletoe of lodgepole pine. U. S. Dept. Agric., Forest Pest Leaflet 18, 7 pp.

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Survival, Root, And Shoot Growth Of Six Bottomland Tree Species Following Flooding

Differences in tolerances of various tree species to flooded soil conditions and subsequent poor aeration have been reported by a number of investigators. In general these tolerances have been attributed to either a translocation of oxygen or oxidized substrate via the shoot (*2, 4, 5*) or to the development of an adventitious root system in water above the poorly aerated soil (*1, 3*).

During the sumer of 1958 a preliminary test was made to determine the responses of six bottomland tree species to flooded soil conditions and subsequent well-drained soil condition. The following account gives the results of this test. The tree species used were: green ash (*Fraxinus pennsylvanica* Marsh.), eastern cottonwood (*Populus deltoides* Bartr.), hackberry (*Celtis occidentalis* L.), cherrybark oak (*Quercus falcata* var. *pagodaefolia* Ell.), pin oak (*Quercus palustris* Muenchh.), and sycamore (*Platanus occidentalis* L.).

The test was made with current year seedlings started in 7-inch unglazed clay pots containing a silt loam soil with an organic matter content of approximately 4 percent. Each pot, at the beginning of the test, contained five approximately uniform seedlings. The soil was kept saturated by placing the pots in 2-gallon glazed jars and adding enough tapwater to cover the surface of the soil to a depth of approximately one quarter of an inch. The submergence test was started July 14 and ended August 21. Additional pots similar in all respects except for flooding were used as controls.

At the end of 38 days the root systems of the seedlings were washed out of the soil. Following brief observation of the exposed roots the four most vigorous appearing seedlings were placed in a prepared loam soil which subsequently was kept moist but well drained. After 60 days under these conditions the root systems were again washed from the soil for further observations.

Table 1 and Figures 1 and 2 summarize the results of these tests.

The results showed pronounced differences among the six species in the ability to adjust to the changing soil moisture conditions. Upon flooding the cottonwood, sycamore, and ash seedlings rapidly developed adventitious root systems, whereas the oaks and hackberry seedlings did not produce adventitious roots. In addition the ash developed new laterals well below the soil surface. The adventitious roots in all cases developed at and slightly above the soil surface. Except for one seedling, the tops of the oaks remained alive but the hackberry seedlings appeared dead within three weeks. All roots surviving inundation continued to develop in the well aerated soil medium. In addition, the surviving oak seedlings weakly developed new secondary roots. The six species are ranked in Table 1 according to their ability to withstand and recover from saturated soil conditions.

It appears that the survival and growth of cottonwood and sycamore is directly related to the formation of adventitious roots; whereas ash, in addition to the formation of adventitious roots, is also able to produce new roots in poorly aerated media. The latter result suggests that ash may have the ability to translocate oxygen or oxidized substrate to the roots via the shoot. The oaks producing no new root systems showed a poorer

TABLE 1.—RELATIVE EFFECTS OF SATURATED AND SUBSEQUENT WELL-DRAIND SOIL CONDITIONS UPON THE SURVVIVAL, ROOT, AND SHOOT GROWTH OF SIX BOTTOMLAND TREE SPECIES

	Effects of saturated soil[1] — 38 day period		Well-drained soil[2] — 60 day period	
Species	Roots	Shoots	Roots	Shoots
Cottonwood	Root system died; extensive adventitious root system developed rapidly.	Slightly chlorotic; height growth 77% of controls.	Adventitious roots continued to develop	Rapidly regained color and continued to grow.
Green ash	Established secondary roots died; new secondary roots developed; rapidly developed adventitious root system also.	Slightly chlorotic; height growth 21% of controls.	All roots surviving inundation continued to develop.	Rapidly regained color and continued to grow.
Sycamore	Developed adventitious root system but not as rapidly or extensively as above species.	Deep chlorosis changed to brick red color within three weeks; height growth 13% of controls.	Adventitious roots continued to develop.	Regained color, slowly; height growth much delayed.
Pin oak	Secondary roots died; did not develop adventitious roots.	All seedlings became deeply chlorotic; neither treated nor untreated seedlings grew in height.	Weakly developed new secondary roots.	One died and began to sprout, others lost most of leaves; no new leaf or top growth.
Cherrybark oak	Secondary roots died; did not develop adventitious roots.	One seedling died within three weeks, others became deeply chlorotic; did not grow in height, controls continued to grow.	Weakly developed new secondary roots.	Most of leaves died; stems remained green; no new leaf or top growth.
Hackberry	All roots died.	All were apparently dead within three weeks.	Did not recover.	Did not sprout.

[1]Based upon five seedlings.
[2]Based upon the four most vigorous appearing seedlings following saturated soil conditions.

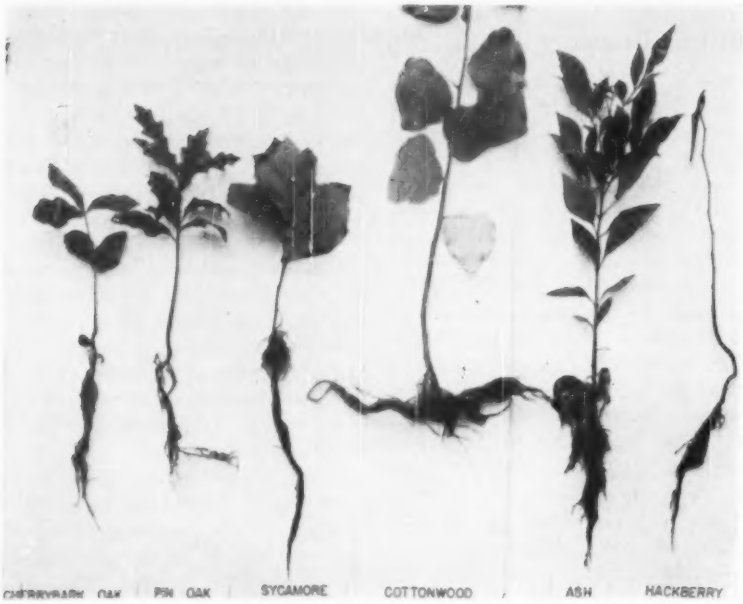

FIG. 1.—The root systems of six bottomland species following 38 days of flooding Note the species differences in adventitious root formation. Except for ash, the smaller secondary roots of all species below the soil surface were dead.

adaptation to soils saturated for long periods.

This ability to adapt to changing soil moisture conditions probably plays an important part in determining the ecology of tree species in bottomland hardwoods. However, the fact that pin oak, hackberry, and cherrybark oak are often found on wetter sites than cottonwood and sycamore suggests that factors in addition to flooding need to be investigated in determining the role of these tree species in the succession of bottomland hardwoods.

Literature Cited

1. BERGMAN, H. F. 1920. The relation of aeration to the growth and activity of roots and its influence on the ecesis of plants in swamps. Ann. Bot. 34: 13-33.

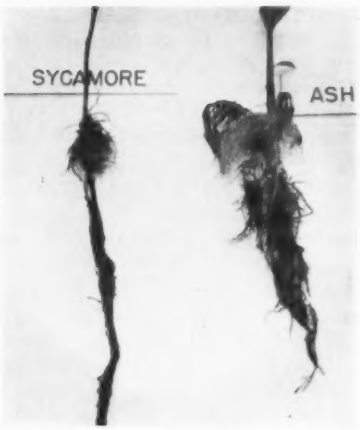

FIG. 2.—A close-up of the root systems of sycamore and ash following 38 days of flooding. The ash exhibits live root tips well below the surface of the ground.

2. HUIKARI, O. 1955. Experiments on the effect of anaerobic media upon birch, pine, and spruce seedlings. Comm. Inst. for. Fenn. 42:5.
3. KRAMER, P. J. 1951. Causes of injuries to plants resulting from flooding of soil. Plant Physiol. 26:722-736.
4. LEYTON, LEONARD, and L. Z. ROUSSEAU. 1958. Root growth of tree seedlings in relation to aeration. In *The Physiology of Forest Trees*, edited by K. V. Thimann. Ronald Press Co., N. Y. pp. 467-475.
5. MCVEAN, D. N. 1956. Ecology of *Alnus glutinosa* (L.) Gaertin. IV. Root System. J. Ecol. 44:219.

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Points of View

Forest Fire Research and Education in the Southeast

Professor Reifsnyder's excellent discourse in the August 1959 JOURNAL on the importance of fire protection, behavior and use, and the relative inffectiveness of the professional educational effort in these areas, has been needed for some time. Lest he and the readers of the JOURNAL gain the impression that we are all "asleep at the switch," I hasten to outline a few of the developments taking place here in Georgia.

The George Foster Peabody School of Forestry at the University of Georgia is in a unique position to assume leadership as a regional institution offering specialized training, primarily at the graduate level, in forest fire applications and characteristics. We aim to assume such leadership. Nearby we have the Regional Office of the U. S. Forest Service in Atlanta with its Division of Fire Control and the Southeastern Forest Experiment Station in Asheville with its Division of Fire Research. In Macon is the headquarters of one of the best supported and most efficient state forest fire organizations in the country: the Georgia Forestry Commission. For moral and financial support, we have the Georgia Forest Research Council, also centered in Macon. Finally, there is erected and "ready for business" in Macon a $450,000 Forest Fire Research Laboratory which, at present, is the only one of its kind anywhere. Macon is a two-hour drive from the campus in Athens.

When I assumed the deanship at Georgia a little more than two years ago, I set out to find a scientist of unknown variety who would be qualified to head up the instructional and research effort in the forest fire area. Whether I was seeking a chemist, a physicist, an agronomist, an engineer, or a meteorologist, I was never quite sure. But of one thing I felt certain—I did not want a forester, for any forestry graduate would be "tainted" with the usual undergraduate instruction offered in a forest fire course. My objective was a man completely innocent of the forest fire situation, but one well grounded in basic science and possessed of an open mind.

On August 1 such an individual joined our faculty. He is James A. Shear, recently of the University of Kentucky. Dr. Shear was a physics major as an undergraduate and minored in statistics. His Master's work was in meteorology and his doctorate in climatology. He served for a time as forecaster for Eastern Airlines at LaGuardia Field and was in Antarctica with the IGY. We feel most fortunate in having Dr. Shear with us. Without any preconceived ideas, yet with the support of all manner of professional foresters, he should be able to tackle the fire enigma and be outstandingly successful, in our opinion.

It would be a bit premature to aver that Georgia is already operative in this area of post-graduate training in fire behavior and use. Yet it should provide some balm to Professor Reifsnyder and others to learn that at least one school is doing more than thinking about the matter of forest fire education and research.

A. M. HERRICK
Dean, School of Forestry,
University of Georgia, Athens

Comments on Terminology for Wet Lands

The terms "swamp" and "bog" are frequently used to denote any form of wet ground. In practice it is necessary to be more precise than this in determining the conditions in which forests grow, and precision becomes of even greater importance when it is desired to introduce exotic species

There are numerous terms for wet ground, and Table 1 compares brief definitions from the Oxford and from Webster's Dictionaries.

These are not entirely helpful, since many of them are "circular" definitions. In common parlance most of them are interchangeable with each other. The term "muskeg" is not included since it does not have international currency, though it does appear in "British Commonwealth Forest Terminology," Part 1.

Any of them can of course be further clarified by adjectives; for example, the terms "Sphagnum bog" or "acid swamp" could be used. Certain of them are already used in forestry in a more restricted sense; for example, the term "flush" has a specific meaning in British moorland afforestation. However, like the other terms above, it is not mentioned in "British Commonwealth Forest Terminology."

It would appear that a more precise definition of terms would be of considerable help, once they were accepted and used universally. In the simplest terms it is necessary to define at least three types: forests on wet acid land; forests on fertile lowland peats; and forests on wet alluvial land subject to periodic and sometimes lengthy inundation.

Webster's definitions are in some cases more detailed than those found in the Oxford Dictionary. But taking the two together, the following terms would seem to be sufficient:

TABLE 1.—COMPARISON OF WET-GROUND TERMS

	Oxford[1]	Webster's[1]
Bog	Wet spongy ground; morass.	A tract of wet spongy ground, composed of decayed and decaying vegetable matter. Quagmire, marsh, morass.
Bottomlands	Low lying land.	Low lands, along river banks, formed by alluvial deposits.
Fen	Low marshy or flooded tract of land.	Low, flat marsh land, covered with sedges, etc.
Flush	A rush of water.	A sudden rush of water. A bog or morass.
Marsh	Low land flooded in winter and usually watery at all times.	A swampy tract of land.
Moor	Tract of open waste ground.	An extensive tract of waste land covered with heather; sometimes marshy or peaty.
Morass	Bog, marsh.	A swamp; fen.
Quagmire	Quaking bog, fen, marsh, slough.	Wet boggy ground yielding under the feet.
Slough	Quagmire, swamp, miry place.	Deep muddy place; a bog.
Swamp	Piece of west spongy ground, bog, marsh.	Wet or boggy land; soft, low land saturated with water.

[1]*Oxford Dictionary*, Concise edition 1950; *Webster's New Peerless Dictionary*, 1943.

Bog.—Wet acid peaty land, with water in the soil tending to be stagnant or slow moving; characteristically Sphagnum is present or abundant.

Sub-type *Flush.*—A free draining area in peaty acid tracts of land.

Bottomland or Marsh.—Low lying fertile alluvial land subject to periodic flooding and usually wet at all times.

Swamp.—Low lying fertile peat land periodically inundated and generally saturated with water at all times.

The definition of forest types would be simplified by using the terms "bog forest," "bottomland forest," and "swamp forest," while the remaining terms could be used to define non-forested land.

This short analysis is presented rather as a subject for discussion and eventual resolution than as a final definition for use in forestry. In the meantime it would be helpful if authors describing silvical characteristics would define soil types and conditions more exactly than is presently the case.

C. G. R. CHAVASSE
New Zealand Forest Service,
Hokitika, New Zealand

❦❦❦

The Cover.—A record 190,000 bushel harvest of seed cones this fall was reported by Royce O. Cornelius, Weyerhaeuser Company managing forester. He said the cones should yield about 100,000 pounds of seed for reforestation programs.

Hundreds of weekend cone collectors were paid $427,500 by Weyerhaeuser for their spare-time efforts.

The record harvest compared with 3,500 bushels in 1955, 43,000 in 1956, 30,000 in 1957 and 20,000 in 1958. Cornelius said the cone crop this year was the best since 1946.

Seeds are extracted from the cones by the company at the rate of 1,000 bushels per day in a newly constructed plant near Chehalis, Wash., and another near Cottage Grove, Ore. Each cone will yield between 20-40 seeds with about 40,000 Douglas-fir seeds in a pound.

The 190,000 bushels harvested this fall will seed 100,000 acres of harvested forest land. A helicopter can spread one pound of seed on an acre of land in 15 seconds. Some of the seed will be used in Weyerhaeuser nurseries to provide seedlings for later hand planting.

Book Reviews

Natural Resources

Edited by Martin R. Huberty and Warren L. Flock. 556 pp. Illus. McGraw-Hill Book Company, Inc., New York. $11.

One of the major problems faced by foresters today is that of keeping pace with the changing tools and techniques of the forestry profession. Yet despite obvious pressures toward specialization, most foresters recognize that forestry itself is a special area of the much wider field of natural resource management. If the forester is to merit the title of "professional" rather than "technician," he must at least be aware of developments and thinking in the fields peripheral to his own. *Natural Resources* provides an excellent means of obtaining this awareness.

This book grew out of a series of lectures given in 1955 under the auspices of Engineering Extension of the University of California, Los Angeles. Most of its 20 chapters are concerned with the resources usually considered essential to man's continued existence—soil, water, forests, air, minerals, food, etc. These chapters are handled in excellent fashion by the chosen experts. The chapter devoted to "Forest and Forest Products" maintains the high standards that Prof. Zivnuska has established in his previous writings. Of particular interest is the fact that special attention is given to technological developments and problems in each of the natural resource fields. In this respect the chapters on air pollution, nuclear energy and geophysical exploration seemed particularly well done to this reviewer, as did the chapter discussing problems of obtaining fresh water from saline sources.

Excellent though these technical presentations are, the most significant sections of the book are those given to basic concepts and considerations. The first chapter, "Natural and Human Resources" by Varden Fuller, struck this reviewer as outstanding. Prof. Ciriacy-Wantrup's discussion of "Economics and Policies of Resource Conservation" will strike many readers as particularly fresh and original, even though the chapter is essentially an introduction to the concepts presented in much greater detail in his earlier book *Resource Conservation*. Foresters will also find the chapter on Photosynthesis a succinct summary of technological developments in this interesting area.

For a book growing out of a series of lectures given by different individuals, the writing is remarkably "even." It should be read by everyone professing to a knowledge of natural resource management—and particularly by professional foresters who, after all, provided the intellectual wellspring for much of the conservation movement itself.

G. R. Gregory
School of Natural Resources, University of Michigan

The College Blue Book

Edited by Christian E. Burckel. 9th ed. 1,168 pp. Universal Lithographers, Inc., Baltimore, Md. 1959. $22.50.

That the world of education is a complex and diverse one is clearly demonstrated by even a casual browsing through *The College Blue Book*. This imposing volume, published through nine editions since 1924, is described by its editor as "The professional work of reference of higher and secondary education in the United States of America." The *Blue Book* lists, as of June 1958, all of the known institutions of higher education, with pertinent data about each. It gives information concerning agencies, organizations, associations and foundations "that influence the character of higher education in the United States and that determine to a large extent the curricular contents of secondary education." Thirdly, Mr. Burckel, with the help of numerous advisers, has analyzed education from the aspect of the individual professional and cultural disciplines it supports. As an example of the latter, one of the *Blue Book's* 88 sections is devoted to forestry. This section lists the institutions teaching forestry, with explanatory data concerning each; describes in detail the bases used for accrediting professional training; and gives a brief outline of the nature, character, and purposes of organizations related to forestry.

Arthur B. Meyer

Conifers: South African Methods of Cultivation

By W. E. Hiley. 123 pp. Illus. Faber and Faber, London. 1959. 21s.

Just 20 years ago Dr. I. J. Craib published a bulletin[1] that charted the main course forestry has since followed in the Union of South Africa. This course in many ways represented a radical departure from the silvicultural practices developed and used in Europe and North America.

The basic principle of the South African system is to grow the trees throughout the rotation with little or no competition. This involves planting at a moderately wide spacing (9×9 feet is a general standard), frequent thinnings at prescribed times and to prescribed

[1]Thinning, pruning, and management studies on the main exotic conifers grown in South Africa. Union of South Africa: Dept. of Agric. and Forestry, Sci. Bull. No. 196. 1939.

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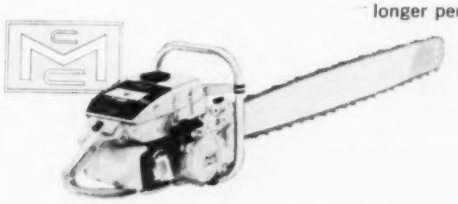

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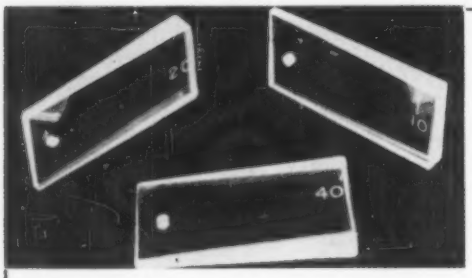
numbers of trees per acre, and pruning in three stages to a height of 22 feet. It should be pointed out that South African forestry is based almost exclusively on the culture of exotics, chiefly pines and wattles (acacia species).

The author of this brief book is a British forest economist. He first visited South Africa in 1947 and was very favorably impressed with the possibility that the South African methods would permit production of wood cheaper than the conventional methods used in Britain and most other lands where forestry was being practiced. He returned again in 1957, when the prescriptions had been in use about 20 years, and made a rather extensive trip through pine plantations of the Union and talked with numerous forest managers. His conclusion was that the system definitely works, and works well. His enthusiasm at the results led him to write this book.

Mr. Hiley tells his story clearly and well. In the nine chapters of the book he points out that the South Africans have approached forestry more from the viewpoint of agriculture than of ecology; he describes the "numerical" thinning methods, the two general areas where climatic conditions are suitable for pine planting in South Africa, and shows the proportion devoted to the principal species (*Pinus patula* from Mexico, *P. elliottii* from southeastern United States, *P. pinaster* from Portugal, *P. roxburghii* from the Himalayas, and *P. radiata* from California in order of priority, are most widely used); he discusses the practices employed in nursery work, ground preparation, planting, replanting, release, and pruning, as well as thinning; he points out how a combination of bold planning, rapid-growing species, favorable climate, good soils, high demand for work, and cheap labor makes conifer forestry a profitable enterprise for both public and private agencies; he describes the special stand-density ("correlated curve trend") plots that are maintained for the principal species in different localities as a running check on thinning prescriptions; and he gives a brief account of the harvesting, milling (by both state and private mills), selling, and quality of the wood from these plantations (now about 500,000 acres in the Union).

The reviewer commends this book to American foresters, especially those concerned with planting and plantation management. The book is short, interesting to read, well illustrated with photographs and figures, and it presents some ideas that may make us want to take a second look at some of our practices. We may find justifications here for more comprehensive growing-stock-level studies begun earlier in the life of the stand. The reviewer joins with the author in suggesting more trials of the South African stand management ideas in other lands.

PAUL O. RUDOLF
Lake States Forest Experiment Station



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Methods of Vegetation Study

By Edwin Allen Phillips. 107 pp. Illus. Henry Holt and Co., Inc., New York. 1959. $2.95.

In a survey of vegetation study techniques Mr. Phillips not only provides the teacher with a bountiful array of field exercises but also presents a concise and lucid summary of the major types of sampling techniques used by phytoecologists and phytosociologists of the United States as well as Europe. Even though this text was written primarily for beginning students in plant ecology, it will also serve as a very enlightening source of information for the practicing forester who is confronted with vegetation sampling problems.

As a means of classifying his 25 objective chapters, the author has grouped the material into eight logical subject areas (parts) each with its own appropriate series of field exercices. In all, 56 field and laboratory exercises are offered to be used at the discretion of the

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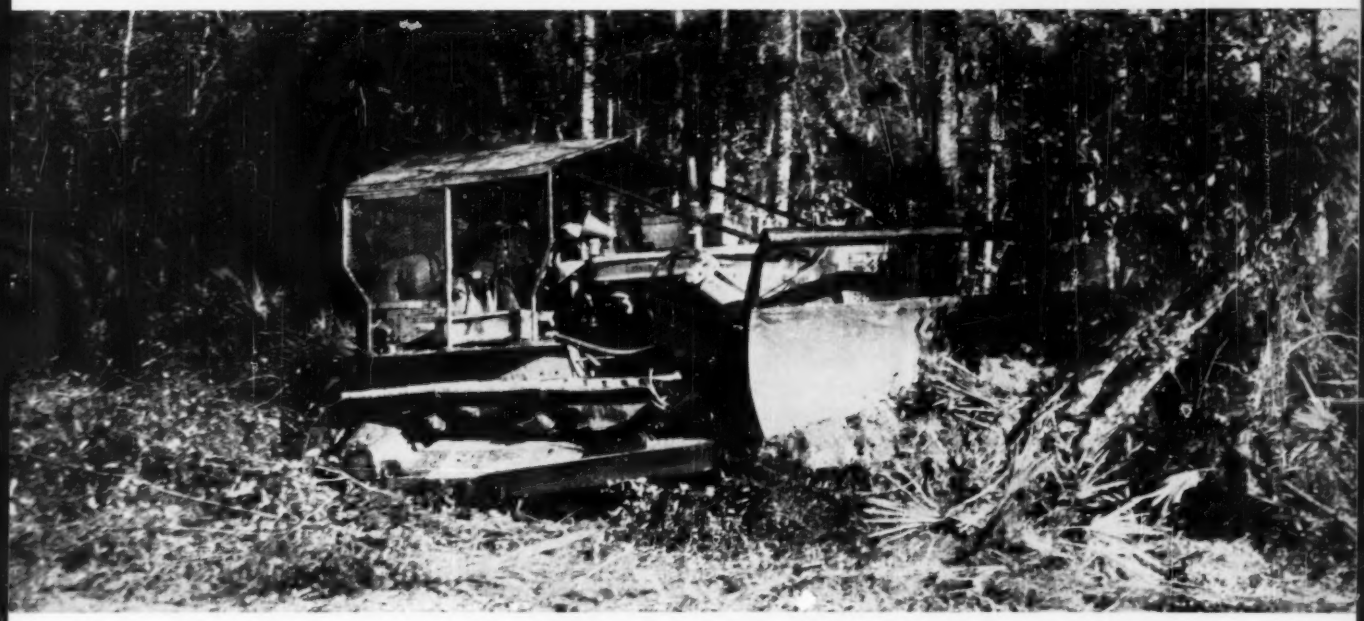

An acre an hour is good production in this going. But just as important is the *way* the D6 with a Rome K/G Clearing Blade handles the job. Forester Wess Whiddon of the Weaver-Loughridge Lumber Co. in Boyd, Florida, makes this comment on its performance: "The K/G Blade is rugged. It is doing more than we expected. It piles debris very well—does not take topsoil. You can't beat a D6 for this type of work."

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teacher—for there is more than enough material for a two-semester course on plant or bio-ecology. Since the part titles supplied by the author are self-explanatory they also serve as a summary of the contents: (1) Preliminary survey; (2) Physiognomic systems; (3) Floristic systems; (4) Succession; (5) Analytic qualitative concepts; (6) The synthesis of data from different stands (13 chapters and 18 exercises); and (7) Artificial populations.

During the summer of 1959 the reviewer had the opportunity to use the text as a laboratory guide in two seven-day field courses in plant ecology. Since many areas of abandoned farm lands were readily available in the Upper Peninsula of Michigan, emphasis was placed on successional concepts and analysis. Enough exercises were presented in Phillips' text to practice a multiple of analyses in one area or conversely to study several areas using one or a few techniques. Lacking, however, are standard tests of statistical significance to determine the extent of homogeneity within physiognomic or other vegetation types, and examples of experimental design to assure adequate replication number and pattern. Although mention is made of choice of sampling in exercise 11 "Effect of distribution of samples" the exercise would be strengthened if more statistical analyses would be included.

The language of the text is clear and simple. The concepts presented are quite readable and are accompanied by helpful tables and diagrams. Of particular interest to the range manager and forester are exercises in the plotless cruising techniques of the "point-frame" method, "Bitterlich method," "random pairs," and "quarter method." A short paragraph advising the reader of the adjustment for slope correction if over ten percent would be helpful in the "Bitterlich exercise."

One of the more commendable features of the book is the citation of the original papers that first advanced the methods and theories explained in the text. Thus, if interested, the reader can obtain additional details and formulae derivations. Also included in the bibliography is a list of 26 pertinent reference books, the titles of eight ecological journals (including *Forest Science*), and the names of 20 other journals that include occasional ecological papers. An appendix provides a list of requisite field and laboratory instruments. Because several of the exercises require randomization procedures, a table of random numbers included in the text or as an appendix would be of value.

Since the book is pocket sized (5½ by 8¼ inches) and the cover is of a durable and pliable plastic, it can readily be included in a field pack or inserted in a jacket pocket. The moderate price and valuable contents of Phillips' book should afford wide acceptance and use by foresters as well as students of plant ecology.

JOHN W. ANDRESEN
Michigan State University

California Natural History Guides 1, 2, 3, and 4

Illus. University of California Press, Berkeley, Calif. 1959. $1.50 each.

The four pocket-sized volumes of the California Natural History Guides are, as the subtitle on each volume states, ". . . of the San Francisco Bay Region." all volumes are aimed at helping people to know and understand the natural history of a ten-county area bordering San Francisco Bay, rather than to serve as reference for trained and advanced workers. However, anyone, amateur or professional, will find these attractive publications worthwhile. There is generous use of black and white drawings and color illustrations.

An "Introduction to the Natural History of the San Francisco Bay Region," by Arthur C. Smith, is exceptionally well done. The author has avoided "talking down," yet has explained technical

matters, such as scientific names and identification keys, in a manner that should stimulate a desire to learn. All outdoor interests in natural history are encouraged. Where some writers would deplore hunting, Smith invites them to know the plant and animal life so they will derive additional enjoyment from their time in the field. The discussion on biotic communities is a good guide to beginners. By text, illustration, and a table (16 communities), data are given on the location and characteristic plants and animals for marsh areas, forest types, grasslands, and other communities.

The three titles having to do with specific groups are "Reptiles and Amphibians," "Mammals," and "Trees." Presumably, there will be additional guides. The one on reptiles and amphibians by Robert C. Stebbins strays away from the appealing approach so nicely developed by Smith. Although the information is interesting, there is a tendency to let the reader know that the author is informed on related species elsewhere in the world. "Mammals," by William D. and Elizabeth Berry, is prepared in a manner to show the authors' close knowledge of the habits of mammals and their personal interest in them. This is illustrated by the information on where and when to see the species they describe. The Berrys' defense of their animal friends is not hidden as they have a good word to say for the predators and, by implication, disapprove hunting of deer and other game.

Of particular interest to foresters is "Trees," by Woodbridge Metcalf, well-known and popular forester with the California Extension Service, now retired. Although the author has a deep interest in all trees, the volume is limited to 52 native tree species that are usually single-stemmed and at least 15 to 20 feet tall at maturity. For those who wish to know a tree more intimately, Metcalf suggests keeping a record of a tree's growth and development throughout the year. Each species writeup gives data on leaves, flowers and fruit, and range, plus a general statement on character and uses. In the latter, the author's forestry training was not suppressed, as he mentions uses for the wood for most species, even though some are limited to fuel.

LLOYD W. SWIFT
Division of Wildlife Management, U. S. Forest Service

Publications of Interest

The Northeastern Forest Fire Protection Commission and the U. S. Forest Service have recently published the second in a series of manuals for forest fire control. This one is entitled *Fire Fighting Methods and Techniques.* The manual is a condensation of portions of the training material presented at the annual training sessions of the Northeastern Compact during the years 1954 through 1958. It is designed as a reference manual for the use of fire control officers in the prevention and control of forest fires and in the training of forest fire control personnel.

It contains a wealth of material on many aspects of the fire control problem including fire behavior, suppression methods, use of aircraft, sizing up a fire situation, selection of specific suppression methods, boards of review and other topics. It also includes a brief explanation of the Northeastern Compact.

Although written by and for fire control men in the northeastern states, it should prove useful in all areas of the United States and Canada. Copies of the 360-page manual, priced at $5.00, may be obtained from the Commission at the State Bank of Albany Building, Chatham, N. Y.

* * *

The John Deere 20-page booklet *Logging Logic,* is off the press. The booklet parallels, in its printed message, the same general story on modern logging methods as covered on film in the new John Deere color motion picture, also entitled "Logging Logic." The booklet contains on-the-job logging pictures of special interest to loggers in any section of the country. It is available without charge from John Deere Industrial Division, 3300 River Drive, Moline, Ill.

"A splendid reference." **Hardy L. Shirley,** *State University of New York*

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Reginald D. Forbes, Consulting Forester;
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Essentials of Forestry Practice
Charles H. Stoddard

A practical textbook relating the purposes and working methods of applied forestry to the challenging problems of efficient, farsighted forest management. Describes all important field practices, operations. *89 ills., maps, tables; 258 pp. 1959.* $5.50

Forest Soils
Their Properties and Relation to Silviculture
S. A. Wilde, University of Wisconsin

Well-illustrated book interprets relationships between forest management and soil properties. Correlates physics, chemistry, biology of soils with main aspects of forest stands. *216 ills., tables; 537 pp. 1958.* $8.50

The Physiology of Forest Trees
Edited by **Kenneth V. Thimann,** Harvard University

A major contribution to biological science resulting from the First International Symposium on Forest Tree Physiology. 33 participating scientists discuss the ascent of sap, aspects of translocation, photosynthesis, etc. *233 ills., 678 pp. 1958.* $12

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Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University College of Forestry at Syracuse University*
Range Management Section Compiled by NELLIE G. LARSON, *Library, U. S. Department of Agriculture*

General

Characteristics of Subalpine Spruce in Alberta. By K. W. Horton. 20 pp. Illus. Canada Dept. of Northern Affairs and Nat'l. Res. Forestry Branch, Ottawa. 1959. Tech. Note No. 76.

Commercial Foreign Woods on the American Market. By D. A. Kribs. 203 pp. Illus. Pennsylvania State Univ., University Park. 1959. $30.00. By subscription.

The Development of Industrial Forestry in the Northeast. By C. S. Herr. 50 pp. Illus. Univ. of Washington College of Forestry, Seattle. 1959. The Colonel William B. Greeley Lectures in Industrial Forestry No. 3.

Forest Research Review Year Ended March 1959. 63 pp. Illus. British Columbia Forest Serv., Victoria.

Oaks (Eastern). By H. S. Betts. 24 pp. U. S. Forest Serv., Washington 25, D. C. revised 1959. American Woods. 15 cents (Govt. Print. Off.)

A Quarter Century of Industrial Forestry in the Douglas Fir Region . . . By W. D. Hagenstein. 8 pp. Illus. Industrial Forestry Assn., 1410 S.W. Morrison St., Portland 5, Ore. 1959.

The National Science Foundation will award grants to defray partial travel expenses for a limited number of U. S. scientists who wish to participate in the Eighth International Grassland Congress. This Congress is to be held in Reading, England, July 11-21, 1960.

Application blanks may be obtained from the National Science Foundation, Washington 25, D. C. *Completed* application forms must be submitted by February 1, 1960.

The State Forests of Finland and a General Management Plan for Them Based Upon an Inventory Made in 1951-1955. In Finnish with English Summary. By Olavi Linnamies. 225 pp. Valtioneuvoston Kirjapaino, Helsinki. 1959.

Forest Influences

Putting Weather Records to Work . . . An Introduction to Applied Climatology for Foresters. 24 pp. Oregon Forest Lands Research Center, Corvallis, Ore. 1959. Climatological Note No. 22.

Forest Management

Helicopter Use in Forest Surveys. 31 pp. Illus. British Columbia Forest Serv., Victoria. For. Survey Notes 1957-1958 No. 2.

A Method of Estimating Cubic Volume in Felled Trees. By F. E. Hampf and C. A. Bickford. 11 pp. Illus. Northeastern Forest Expt. Sta., Upper Darby, Penna. 1959. Sta. Paper No. 117.

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The Standardization of Symbols in Forest Mensuration. By J. Van Soest and Others. 32 pp. International Union of Forest Research Organizations, c/o Forestry Commission, 25, Savile Row, London, W.1.

What's Known About Managing Eastern White Pine. 69 pp. Illus. Northeastern Forest Expt. Sta., Upper Darby, Penna. 1959. Sta. Paper No. 121.

Forest Resources

Resource Base for Expanded Markets in the Mountain States. By R. B. Herrington. 36 pp. Illus. Montana School of Forestry, Missoula. 1959. Bul. No. 9.

Southern Pulpwood Production, 1958. By J. F. Christopher and M. E. Nelson. 24 pp. Illus. Southern Forest Expt. Sta., New Orleans, La. 1959.

A Timber Resource Survey for Hawaii (Cover title: A Forest Resource Survey for Hawaii). By W. W. Holt and R. E. Nelson. 12 pp. Illus. Pacific Southwest Forest & Range Expt. Sta., Berkeley, Calif. 1959. For. Survey Release No. 36.

Virginia's Timber. By R. W. Larson and M. B. Bryan. 72 pp. Illus. Southeastern Forest Expt. Sta., Asheville, N. C. 1959. For. Survey Release No. 54.

Logging and Milling

Logging Cableways. By G. Giordano. 145 pp. Plates. UNFAO, Geneva. 1959.

Sawmills and Lumber Production for Twenty-Six Counties in Western North Carolina 1958. North Carolina Dept. of Conservation & Development Div. of Forestry, Raleigh.

Pathology

Fungus Losses in the Paper Industry and Related Research Needs. By R. A. Zabel. 4 pp. Reprinted from TAPPI, May, 1959. Available from the author. State Univ. College of Forestry, Syracuse 10, N. Y.

Protection

Biology and Control of the Pine-Needle-Sheath Miner . . . By R. E. Stevens. 20 pp. Illus. Pacific Southwest Forest & Range Expt. Sta., Berkeley, Calif. 1959. Tech. Paper No. 30.

Forest Pest Conditions in Western United States and British Columbia 1958. 9 pp. Western Forestry and Conservation Assn. Portland 4, Ore.

Investigation on the Injury and Its Control of Silver Spotted Longicorn Beetle to Beefwood. Summary in English. By Wei-Hang Kan. 23 pp. Illus. Taiwan Forestry Research Institute, Taipei, Taiwan, China. 1958. Bul. No. 58.

Pine Root Collar Weevil. By D. C. Schmiege. 4 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. 1959. Forest Pest Leaflet No. 39.

The Red Pine Scale. By C. C. Doane. 7 pp. Illus. Connecticut Agric. Expt. Sta., New Haven. 1959. Cir. No. 207.

Range Management

Bitterbrush Plants Can Be Propagated from Stem Cuttings. By E. C. Nord. 4 pp. Pacific Southwest Forest & Range Expt. Sta., Berkeley, Calif. 1959. Res. Note No. 149.

Grass Varieties in the United States. By A. A. Hanson. 72 pp. U. S. Dept. of Agric., Washington 25, D. C. 1959. Agric. Handbook No. 170. 40 cents. (Govt. Print. Off.)

Grasses of the Texas Coastal Bend. By F. W. Gould and T. W. Box. 75 pp. Welder Wildlife Foundation, College Station, Texas. 1959. Contrib. Ser. C. No. 34.

Improving Southern Idaho Deer Winter Ranges by Artificial Revegetation. By R. C. Holmgren and J. V. Basile. 61 pp. Illus. Idaho Dept. of Fish & Game, Boise. 1959. Wildlife Bul. No. 3.

New Zealand Grassland Association. Proceedings of the Twentieth Conference, Held at Dunedin, November 11 to 14, 1958. 150 pp. Illus. P. O. Box 2298, Wellington, New Zealand. $1.70.

Research on Black Mesa—A Progress Report. 18 pp. Illus. Rocky Mountain Forest & Range Expt. Sta., Fort Collins, Colo. 1959. Sta. Paper No. 41.

Techniques and Methods of Measuring Understory Vegetation. Proceedings of a Symposium at Tifton, Ga., October 1958. 174 pp. Illus. Southern Forest Expt. Sta., New Orleans, La. 1959.

Silviculture

Forest Ecology, the Biological Basis of Silviculture; An H. R. MacMillan Lectureship Address. By H. J. Lutz. 8 pp. Univ. of British Columbia, Vancouver. 1959.

Hazel Foliage Treatments to Reduce Suppression of White Spruce Reproduction. By R. M. Waldron. 17 pp. Illus. Canada Dept. of Northern Affairs and Nat'l. Res. Forestry Branch, Ottawa. 1959. Tech. Note No. 75.

Height Growth of White Pine in Relation to Selected Environmental Factors on Four Sites in Southeastern New Hampshire. By B. Husch. 42 pp. Agric. Expt. Sta., Univ. of New Hampshire, Durham. 1959. Sta. Tech. Bul. No. 100.

Intensity of Preplanting Site Preparation Required for Florida's Sandhills. By R. L. Scheer and F. W. Woods. 12 pp. Illus. Southern Forest Expt. Sta., New Orleans, La. 1959. Occasional Paper No. 168.

Partial Conversion of Poor Hardwood Stands to Conifers by Planting. By L. S. Minckler and R. A. Ryker. 9 pp. Illus. Central States Forest Expt. Sta., Columbus, Ohio. 1959. Tech. Paper No. 159.

Sand Pine Regeneration on the Ocala National Forest. By R. W. Cooper, C. S. Shropmeyer, and W. H. D. McGregor. 37 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. 1959. Prod. Res. Rept. No 30. 20 cents. (Govt. Print. Off.)

Tree Species Recommended for Strip-Mine Plantations in Western Kentucky. By S. G. Boyce and R. W. Merz. 12 pp. Illus. Central States Forest Expt. Sta., Columbus, Ohio. 1959. Tech. Paper No. 160.

Wood Technology and Utilization

The Efficiency of Adhesives for Wood. By R. A. G. Knight. 21 pp. Illus. Great Britain Dept. of Sci. and Indus. Res., London. 1959. For. Products Research Bul. No. 38. 3s.

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Federal Center, Building 85
Denver 7, Colo.

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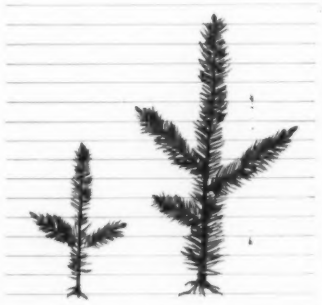

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Coming Events

Kentucky-Tennessee Section

Annual winter meeting at the Andrew Johnson Hotel, Knoxville, Tenn., December 4-5, 1959.

Southeastern Section

Annual meeting in Valdosta, Ga., January 28-29, 1960.

Ozark Section

Winter meeting in Little Rock, Ark., February 12 and 13, 1960.

Appalachian Section

Winter meeting in Durham, N. C., February 12-13, 1960.

Council's Column

The Changing Role of the Forester

Philip A. Briegleb's Council's Column in the March issue of the JOURNAL touched upon what, in my opinion, is a vital issue: The Changing Role of the Forester.

He pointed out that the time is past when the forester is just a forester. Chances are, he now finds himself involved in several dozen specialties like wood utilization, hydrology, soils, wildlife management, and even physics and meteorology.

I would add, however, one field omitted from Mr. Briegleb's list. Today's forester has an important new social role to play—that of the regional planner.

Pennsylvania's Senator Joseph S. Clark, at a recent meeting of the Pennsylvania State Planning Board, said that you could boil down all of the problems in this rapidly growing society of ours to six major issues: shelter, recreation, schools, water, transportation, and employment. As a land management specialist, the forester is vitally concerned with two of these—recreation and water. He is indirectly involved in the others. Employment in many sections of Pennsylvania, for instance, depends heavily upon the state's forest resources. As more and more highways are constructed through our undeveloped areas, they are bound to have an impact upon the state's forests and wildlife.

Fortunately, Pennsylvania has begun to utilize the services of her foresters in planning ahead to meet the needs of the day after tomorrow. This is most dramatically evident in our current attempt to deal with the problem of urban sprawl. At the present time land for park and other public purposes is not saved as buildings and structures take over the landscape. Only a few years later when these buildings are torn down for publicly located and adequate parks, playgrounds, schools, highways, and reservoirs, it is at huge costs. A tremendous backlog of demolition has been created at an astronomical price and the burden increases every day. A bill has been drafted, therefore, which would permit the Department of Forests and Waters to work with local government in reserving open land today for park development tomorrow. Similar legislation is required to reserve lands for such public uses as reservoirs.

This is where the forester, as a member of a national planning agency, a state planning board, or some other agency at the local or municipal level, can perform an invaluable service to his community.

Who knows, for instance, more than the forester about the proper forestation and maintenance techniques for a water supply reservoir?

Who knows more than a forester the kind of woodland that would ideally serve as a recreation site?

Who knows more than a forester where urban encroachments will seriously affect the natural environment?

Several months ago I spoke before a graduation class of game protectors, telling them that if they were entering their chosen vocation because it interested them more than the problems of urban life, they were going into the wrong business. The specialists in conservation today are as involved with the problems of urban life as any city policeman, building inspector, or mayor.

Many of our communities are beginning to realize the unique function which can be served by their foresters. I hope that in the next few years more will do so.

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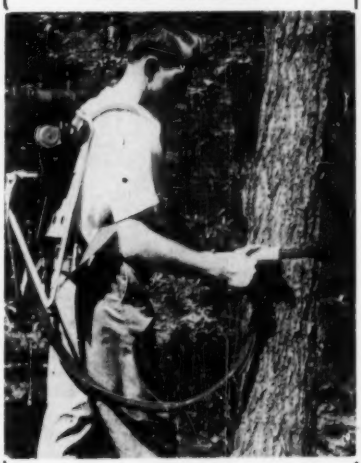

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Central States Section Meets

Tree Improvement was the theme of the 1959 Annual Meeting of the Central States Section which met October 8 and 9 at the Ohio Agricultural Experiment Station located near Wooster, Ohio. The keynote address, "Tree Improvement and Its Relation to Forest Management," was given by Dr. Bruce J. Zobel of the Industry Genetics Program at North Carolina State College. Current tree improvement research in the central hardwood region was reported by representatives from Missouri, Iowa, Illinois, Indiana, and Ohio. This was followed by a discussion on "How Does Forest Genetics Fit Into My Job." Dr. Ernst J. Schreiner of the Northeastern Forest Experiment Station and Dr. Hans Nienstaedt of the Northern Institute of Forest Genetics were among those participating in this portion of the program.

Following an old-fashioned fish fry at noon, nearly 100 members of the Section boarded tractor-drawn wagons and toured the field projects in forest genetics in the Secrest Arboretum. The Arboretum, established more than 50 years ago, contains a worldwide selection of tree species which are being used in tree genetics work.

Included in the tour were stops at the hot beds—cold frames facilities; an oak genotype plot which includes 22 species of oak and a varying number of geographic sources for each species; the white pine breeding arboretum; sugar maple seedling source plot where geographic variation is studied; a Christmas tree variety block used to compare various sources of Scotch pine for such characteristics as color of foliage after frost, growth rate, and form; prostrate mutant black locust plot where the recently found prostrate black locust is being observed; and stops where research with exotic five-needle pines and sugar maple provenance tests are being carried out.

The Central States Section's banquet was held at historic Smithville Inn in Smithville, Ohio. Banquet speaker was Dr. H. A. Fowells of the Forest Management Research Division of the U. S. Forest Service. Dr. Fowell's topic was "Super Trees for Forestry's Future." Chairman of the Program Committee was Howard B. Kriebel.

At the business meeting H. F. Siemert, assistant state forester of Illinois, was advanced from vice-chairman to chairman of the Section; F. Bryan Clark, Bedford (Indiana) research center leader, was elected vice-chairman; and W. O. Schramm of the Alton Box Board Company, Alton, Ill. was elected secretary-treasurer. Schramm will serve two years and Siemert and Clark one year.

C. H. Schaeffer (1897-1959)

Charles Howell Schaeffer, 62, of Tallahassee, Fla., died of a heart attack on October 21, 1959.

Born on August 10, 1897 in Lancaster, Pa., he was a graduate in 1924 of the Pennsylvania State Forest School at Mont Alto.

For a year following graduation he was with the Bureau of Refuges and Lands, Pennsylvania Game Commission. Then followed seven years with the Alabama Commission of Forestry, five years with the Florida Forest Service, and six years with the South Carolina Commission of Forestry.

Since the war he had been with the Florida Park Service in charge of public relations.

Mr. Schaeffer served as a second lieutenant in the Marine Corps in the first World War, and as captain of Marines commanding the guard company at the Philadelphia Navy Yard in the second World War.

He had been a member of the Society of American Foresters since 1925.

George W. Kimball (1888-1959)

George W. Kimball, formerly chief of Region 3 operation division, U. S. Forest Service, died in Albuquerque, N. Mex., September 16, 1959.

Born in Lowell, Mass., December 27, 1888, Mr. Kimball, after receiving his master's degree in forestry from Harvard, went to the Southwest in 1913 as assistant forester on the Moqui District of the old Tusayan National Forest, becoming district ranger in 1915. During World War I he served as a lieutenant in France in one of the Army forest engineer regiments. He returned to the Tusayan after the war, became supervisor in the early 1920's and remained until 1934 when the Navajo Bridge was built and the Kaibab was consolidated with the Tusayan under the name of Kaibab. He served in Region 3 office in operation from 1934 until his retirement in 1950. He became a member of the Society of American Foresters in 1921.

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Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of October are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of December 1959.

Communications from the voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Alaska Section

Junior Grade

Thaanum, R. F., Forester, USFS, Juneau, Alaska (Reinstatement).

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Berkey, D. L. — Lindsey, K. D.
Even, D. R. — Martin, R. W.
Grundhofer, R. E. — Nuss, M. E.
Hill, T. M. — Pero, R. H.

Junior Grade

Dainty, G. E., Forester, The D. M. Bare Paper Co., Roaring Spring, Pa., Mich. State, BSF, 1950.

Howard, G. P., Asst. Wildlife Mgr., N. J. Div. of Fish & Game, Trenton, N. J. (Reinstatement).

Kirch, J. H., Research Forester, Amchem Products, Inc., Ambler, Pa. (Reinstatement).

Student Eligible for Automatic Advancement

PENNSYLVANIA STATE UNIVERSITY

Abboy, C. W.

Appalachian Section

Student Grade

DUKE UNIVERSITY

Clayton, J. E. — Hudspeth, H. S.
Collins, D. J. — McQuilkin, R. A.
Czerepinski, F. P. — Towers, B.
Drayton, E. R. — Weaver, R. S.
Fish, R. B. — Wellons, J. D.

Junior Grade

Jones, M. B., Dist. Forest Ranger, Sumter Natl. Forest, Greenwood, S.C. (Affiliate 1956).

Kiser, W. R., Dist. Forester, N. C. Dept. of Cons., Chapel Hill, N. C. (Reinstatement).

Affiliate Grade

Crichton, D. D., Asst. Forester, Continental Can Co., Inc., Hopwell, Va.

Central Rocky Mountain Section

Junior Grade

Matlack, D. D., Forester, USFS, Colorado Springs, Colo., Colo. State BSF, 1956.

Students Eligible for Automatic Advancement

COLORADO STATE UNIVERSITY

Anderson, C. R. — Hutchins, J. N.

Central States Section

Student Grade

PURDUE UNIVERSITY

Allen, R. K. — Kirkman, R. S.
Ballantyne, R. K. — Martin, C. A.
Baranyay, W. G. — Miller, C. H.
Bunger, T. T. — Naugle, D. L.
Copes, D. L. — Rayburn, R. G.
Karp, J. — Tritch, J. W.
Vergin, D. L.

Member Grade

Beers, T. W., Instructor, Purdue Univ., Lafayette, Ind., Pa. State, BSF, 1955, MS, 1956. (Junior 1955).

Laverdiere, R. J., Farm Forester, Ill. Div. of Forestry, Macomb, Ill., Mich. Tech., BSF, 1947, Mich. State, MS, 1952 (Junior 1952).

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Axon, N. A.

Member Grade

Mallery, W. T., Tbr. Staffman, USFS, Pendleton, Ore. (Reinstatement).

Gulf States Section

Student Grade

LOUISIANA STATE UNIVERSITY

Anderson, M. H. — Evans, G. J.
Aulds, C. B. — Impson, J. W.
Chisum, A. B. — Jones, B. C.
Cole, J. F. — McCormick, J. R.
Cole, R. — Mills, R. H.
Cooley, J. — Naff, N. F.
DeSoto, V. V. — Redding, B. W.
Earnest, W. C. — Robinson, B. H.
Saxon, S. N.

Junior Grade

Layson, A. W., Asst. Dist. Forester, Hiwassee Land Co., Iuka, Miss. (Reinstatement).

Rockett, B. O., Area Forester, Continental Can Co., Inc., Hodge, La., LPI, BSF, 1950.

Student Eligible for Automatic Advancement

LOUISIANA POLYTECHNIC INSTITUTE

Palmer, W. M.

Affiliate Grade

Chessher, J. H., Dist. Forester, S. W. Settlement & Dev. Co., Woodville, Texas.

Karr, J. W., Forester, Edgewood Land & Logging Co., DeQuincy, La.

Inland Empire Section

Junior Grade

Klein, P. L., 1309 20th St., Lewiston, Idaho (Reinstatement).

Affiliate Grade

Larson, Q. W., Forestry Aide, Kaniksu Natl. Forest, Sandpoint, Idaho.

Intermountain Section

Student Grade

UTAH STATE UNIVERSITY

Ashley, R. R. — Jahnke, G. R.
Evans, R. J. — Kaufmann, T. R.
Hook, D. D. — Spalding, F. L.
Wilhelm, C. S.

Junior Grade

Anderson, A. E., Asst. Dist. Forester, Hiwassee Land Co., Kingston, Tenn. (Reinstatement).

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Student Grade

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Junior Grade

Student Eligible for Automatic Advancement

UNIVERSITY OF MAINE

Kratz, R. N.

New York Section

Junior Grade

Arnold, C. L., Forester, N. Y. State Cons. Dept., Bath, N. Y., State Univ. N. Y., BSF, 1959.

Student Eligible for Automatic Advancement

STATE UNIVERSITY OF NEW YORK

Heady, D. R.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Allardice, J. R. Heitkotter, B. W.
Cecchi, R. B. Leimbach, P. A.
Dunaway, D. J. Payne, B. R.
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Junior Grade

Martin, R. M., Tbr. Mgmt. Asst., USFS, Willows, Calif., Univ. Calif., BSF, 1957.

Member Grade

Fischer, W. F., Forester, USFS, San Francisco, Calif. (Reinstatement).
Stathem, P. W., Forest Supv., Shasta-Trinity Natl. Forests, Redding, Calif. (Reinstatement).

Northern Rocky Mountain Section

Junior Grade

Steiner, R. W., Dist. Ranger, USFS, Troy, Mont. (Reinstatement).

Students Eligible for Automatic Advancement

MONTANA STATE UNIVERSITY

Lovell, J. V. McLaughlin, W. D.
Schroedel, D. J.

Ozark Section

Student Grade

UNIVERSITY OF MISSOURI

Aubin, F. G. Nielsen, R. R.
Backler, W. E. Null, W. S.
Grunwald, C. H. Palone, W. L.
Lester, J. E. Percival, D. E.
McGuigan, D. D. Sanders, C. C.
Naland, P. R. Schweer, W. R.
Nelson, W. J. Sheiby, W. E.

Junior Grade

Barnhart, C. E., Farm Forester, Mo. Cons. Comm., Lebanon, Mo., Univ. Mo., BSF, 1949.
Thomas, H. H., Consulting Forester, Self-Employed, Doniphan, Mo. (Reinstatement).

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Ballard, T. M. Kaney, D. W.
Broomhead, R. V. Robinson, A. M.
Carpenter, W. V. Sherman, D. A.
Chalberg, V. A. Swanson, D. L.

Member Grade

Malcolm, R. M., Forester, B. C. Forest Service, Victoria, B. C. Canada, Yale, MF, 1951 (Junior 1955).

Affiliate Grade

Joergensen, H. C., Forester, Columbia Cellulose Co., Ltd., Vancouver, B. C. Canada.

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA

Garst, C. Osterman, W. O.
Mustoe, E. F. Paige, V. G.
Poddick, W.

UNIVERSITY OF GEORGIA

Bird, J. D. Free, C. B.
Blalock, T. M. Harris, G. J.
Bond, L. E. Hewes, C. F.
Campbell, D. C. Mixon, J. W.
Carswell, E. P. Moore, G. C.
Cathey, J. E. Morse, W. E.
Claxton, C. T. Nash, F. L.
Clements, L. J. Paris, C. D.
Crosby, F. F. Turner, R. M.
Davis, J. T. Wetherbee, F. P.
Dukes, D. W. Wood, J. H.
Fitzpatrick, D. Woodward, L. A.

Junior Grade

Atchison, F. D., Field Asst., Ga. Forestry Comm., Macon, Ga. (Reinstatement).

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Tinsley, J. M.

UNIVERSITY OF GEORGIA

Allgritton, G. A. Maxwell, J. W.
Arnold, J. C. McEuen, A. R.
Barnhart, J. L. Smith, J. O.
Bennett, E. H. Smith, W. C.
Chesser, J. L. Watson, R. A.

Member Grade

Wiley, H. M., Asst. Supt., Union Bag-Camp Paper Corp., Augusta, Ga. (Reinstatement).

Affiliate Grade

O'Donnell, J., County Forest Ranger, Ga. Forestry Comm., Buena Vista, Ga.

Southwestern Section

Member Grade

Blaser, R. A., Mgr. Southwest Lbr. Mills, Flagstaff, Ariz. (Junior 1951).
Engstrom, G. E., Forester, Carson Natl. Forest, Taos, N. M. (Reinstatement).

Southern California Section

Member Grade

Biddison, D. L., Asst. Dist. Ranger, USFS, Kernville, Calif., Univ. Calif. BSF, 1955 (Junior 1955).

Upper Mississippi Valley Section

Student Grade

IOWA STATE UNIVERSITY

Gutcher, D. G. McCormick, W. J.
Hambrock, R. L. Sampson, G. R.
Kaiser, H. F. Soomerfield, H. P.
Knupp, J. F. Wisch, J. C.

Junior Grade

Ethington, R. L., Instructor, Iowa State Univ., Ames, Iowa, Iowa State, BSF, 1957.
Schantz-Hansen, R., Foresters Aide, Northwest Paper Co., Cloquet, Minn., Univ. Minn. BSF, 1953.

Washington Section

Junior Grade

Baird, C. J., Forester, USFS, Washington, D. C. (Reinstatement).

Member Grade

Sayers, W. B., Director, American Forest Prod. Industries, Washington, D. C. (Reinstatement).

Wisconsin-Michigan Section

Student Grade

MICHIGAN STATE UNIVERSITY

Adams, W. J. Morse, B. E.
Case, J. R. Mortensen, C. O.
Childress, M. J. Ross, M. T.
Derks, R. D. Schultz, R. P.
Gissible, R. P. Smith, R. D.
Gondek, L. S. Taylor, H. W.
Gustavson, R. J. Wickert, A. J.
Matheson, W. E. Wilson, T. A.
Wood, K. H.

UNIVERSITY OF MICHIGAN

Allen, J. E. Lehman, D. A.
Argow, K. A. McVicar, C. A.
Barton, M. A. Schrader, C. R.
Finke, D. L. Warren, R. C.
Woelfel, R. I.

No Section

Corresponding Grade

Kakli, M. S., Asst. Chief, Pakistan Planning Comm., Karachi, Pakistan.

Forestry News

Golden Anniversary of Idaho College of Forestry

More than 300 alumni, faculty, and guests gathered at Moscow, Idaho, on October 22-24 in observance of the fiftieth anniversary of the University of Idaho College of Forestry.

Chairman of the celebration was Vernon H. Burlison, state extension forester. Welcomes were extended by President Donald R. Theophilus and Dean Ernest W. Wohletz. Introductions were made by Charles A. Wellmer of the Intermountain Forest and Range Experiment Station.

A panel of alumni gave brief historical reminiscences, conducted by Dean Emeritus Dwight S. Jeffers. They included A. D. Decker, W. R. Schofield, R. S. Space, L. R. Pugh, C. A. Connaughton, W. G. Guernsey, R. K. LaBarron, J. Cholis, J. R. Stillinger, R. L. Guernsey, R. B. Walkley, B. A. Jayne, and S. M. Jepson.

Dr. Henry Schmitz of Seattle, former professor at the College, and president emeritus of the University of Washington, spoke interestingly of the growth of the forestry program.

At the golden anniversary luncheon, Arthur W. Nelson, Jr., general manager of the Timber Products Division, Champion Paper and Fibre Company, served as toastmaster. Richard E. McArdle, chief of the Forest Service, and former dean of the College, was the guest speaker.

At the golden anniversary banquet, held on the evening of October 23, George M. Jemison, assistant chief of the Branch of Research, U. S. Forest Service, was toastmaster. Henry Clepper of the Society of American Foresters was the dinner speaker on the subject, "The Forestry Profession: Yesterday, Today, and Tomorrow."

The celebration ended with a foresters' field day and outdoor steak fry.

Richard T. Bingham of the Northern Idaho Forest Genetics Center arranged the reception and buffet supper that opened the activities. Frederic D. Johnson was program chairman for the celebration, assisted by K. E. Hungerford, Robert H. Seale, and Franklin H. Pitkin.

American and Pennsylvania Forestry Associations Meet

With an attendance of 400 members and guests, the combined meeting of the American Forestry Association and the Pennsylvania Forestry Association was held at Bedford Springs, Pa. on October 11-14. The theme of the meeting was "Resources and People—A Challenge of Coexistence."

Don P. Johnston, president of the American Forestry Association, and Fred E. Hornaday, executive vice president, welcomed the conferees. The keynote address was given by Eric A. Walker, president of the Pennsylvania State University. A response was made by Lloyd E. Partain, president of the Pennsylvania State Forestry Association.

DeWitt Nelson, director of the California Department of Natural Resources, served as toastmaster at the Monday luncheon. At this luncheon

AT THE 50th anniversary of the University of Idaho College of Forestry. *L* to *R*: Ernest W. Wohletz, dean; Richard E. McArdle, former dean; Henry Schmitz, former member of the forestry faculty; Dwight S. Jeffers, dean emeritus; and Henry Clepper, executive secretary, Society of American Foresters.

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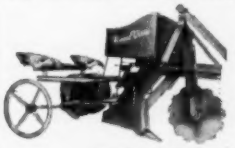

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conservation awards were presented by the American Forestry Association to the following persons:

In the field of public service, Newton B. Drury of Berkeley, Calif., former director of the National Park Service and an Honorary Member of the Society of American Foresters.

In the field of public information, William H. Carr of Tucson, Ariz., curator of the Arizona-Sonora Desert Museum.

In the field of general service, Mrs. Marion T. Weatherford of Arlington, Ore.

In the field of business and industry, Judge Harley Langdale of Valdosta, Ga.

In the field of education, William D. Pine of Eureka, Calif.

C. M. Granger of Washington, D.C. is chairman of the Association's Committee on Awards.

The Pennsylvania Forestry Association's conservation award was presented to Philip A. Livingston, chairman of the Association's Committee on Publications.

At the session devoted to impacts upon the forest resource, Stanley G. Fontana, dean of the University of Michigan School of Forestry, presided. Among the speakers were Conrad L. Wirth, director of the National Park Service and Harold G. Wilm, commissioner of conservation of New York State.

NEWTON B. DRURY

At a following session on meeting the impacts, Charles A. Connaughton, regional forester, U. S. Forest Service, Calif. presided. Arthur W. Greeley, assistant chief of the Forest Service, was moderator.

Among the speakers on this panel were Samuel T. Dana of Ann Arbor, Mich. and M. K. Goddard, Secretary of Forests and Waters, Harrisburg, Pa.

Laurence S. Rockefeller, chairman of the Outdoor Recreation Resources Review Commission, was the speaker at the joint dinner of the two associations.

Post-meeting field trips were taken to forest areas and historic points in West Virginia and Pennsylvania.

Spanish Foresters Study U. S. Wood Production Methods

Six Spanish forestry engineers, intent on improving forestry practices at home, studied modern lumbering and wood utilization operations in the eastern U. S. this autumn. The study was sponsored by the International Cooperation Administration with technical advice being given by the U. S. Forest Service.

Visits to modern sawmilling operations and wood-using plants were scheduled in the northeast, central, and southern states.

Spain's forests are generally understocked and are not being developed rapidly enough to keep up with economic growth. High costs, small plant size, and technical problems of wood-using plants account for a relatively low wood product output.

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By introducing more efficient methods and turning more to the use of machinery in forest utilization, Spain's foresters hope to reduce present timber deficits and ultimately improve the overall forestry situation.

Included in the group was a representative to the Spanish Ministries of Agriculture and Industry, and five high-ranking field leaders in the Spanish Forestry Service. They were all graduates of a five-year forestry engineering course at the national forestry school in Madrid.

Technical leader for the study was E. L. Demmon, former president of the SAF. Demmon recently retired after 33 years with the Forest Service and has since served as a forestry consultant including an assignment with the Free Chinese Government in Taiwan (Formosa).

Joseph L. Fisher Succeeds R. G. Gustavson As RFF Head

Election of Joseph L. Fisher as president and executive director of Resources for the Future, Inc. has been announced by Horace M. Albright, chairman of the Board of Directors of RFF. He succeeds Reuben G. Gustavson, who retired at the end of last August.

Mr. Fisher, who formerly was secretary and associate director of Resources for the Future, also was elected to the Board of Directors. Irving K. Fox, director of water resources studies, was elected associate director. He also will continue in his water research post. John E. Herbert, formerly treasurer of the organization, was elected secretary-treasurer. Mr. Gustavson, who has become professor of chemistry at the University of Arizona, remains a member of RFF's Board of Directors.

Mr. Fisher has been associcate director of RFF since early 1954. Before that he had been an economist with the President's Council of Economic Advisers and administrative assistant to the Council chairman. Earlier, Mr. Fisher was a planning technician with the National Resources Planning Board, economist in the U. S. Department of State, and teacher of economics in various universities.

Forest Farmers Meet in March

The Forest Farmers Association will stage its 1960 Southern Forestry Conference in Jacksonville, Fla., on Thursday and Friday, March 10-11. Headquarters for this 19th annual conference will be the Robert Meyer Hotel.

The Forest Farmers Association, an organization of timberland owners in 15 southern states, holds its annual forestry conference in a different southern city each year. Atlanta, Ga. is association headquarters.

Products Journal Editor Named

John K. McDonald, Madison, Wis., has been appointed editor of the *Forest Products Journal*. He assumed his duties on October 1.

A graduate of the University of Wisconsin School of Journalism, McDonald previously served for 5½ years on the staff of the U. S. Forest Products Laboratory as an editor of research publications.

In collaboration with others on the U.S.F.P.L. staff, he performed editorial duties on such well-known publications as the *Wood Handbook* and *Wood-Frame House Construction*, two widely disseminated publications on wood technology and its practical application.

His duties also included the preparation and dissemination of general releases for newspapers and trade journals, and he is the author of numerous articles that have appeared in trade and technical journals.

He left the laboratory in 1958 to operate a business of his own, and he was also associated with the Mutual Life Insurance Company of New York, before he assumed editorial duties on the *Forest Products Journal*.

Private & Industrial

Fullway Retires From Western Pine

After nearly 31 years as secretary-manager of the Western Pine Association, S. V. Fullway will retire as of December 31, 1959.

His retirement was announced at the recent semi-annual meeting of the Association in Portland Washington.

A Nebraska forestry graduate of 1912, with an MS in 1913, Fullway started his career with the U. S. Forest Service and was supervisor of the Nez Perce National Forest in Idaho from 1918 to 1921. The next six years

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S. V. FULLWAY

he was chief of the office of forest products with the Service at Missoula, Mont. He then served briefly with the National Lumber Manufacturers Association before becoming secretary-manager of the old Western Pine Manufacturers Association in 1929. In 1931 that group merged with the California White and Sugar Pine Association to form the present Western Pine Association.

Industrial Forester Retires

Robert R. Lyman, Sr., manager of West Virginia Pulp and Paper Company's timberland holdings in northern Pennsylvania for the past thirteen years, retired November 1. He will be succeeded as manager of these holdings headquartered at Coudersport by John U. Villesvik, land manager there for the past three years.

Mr. Lyman graduated from Pennsylvania State College in 1919 with a degree in forestry and has long been recognized as an authority on the management of the beech-birch and maple forests widely prevalent in northern Pennsylvania.

Before joining West Virginia, Lyman was forester and later president of the Gray Chemical Company of Coudersport.

John U. Villesvik, who succeeds Lyman, joined the company in 1951 and worked in timberland management at Westvaco's properties in South Carolina, New York, and North Carolina. He moved to Coudersport in 1956.

Villesvik is a graduate of the New York State College of Forestry and earned an M.S. degree in forestry at the University of Michigan.

ROBERT W. HARRIS

Simpson Promotions Announced

Promotions involving three Simpson Logging Company men in public relations and forestry were announced recently by Hal W. McClary, vice president and general manager.

Dave James, who has supervised Simpson public relations and publications since 1947, has been named director of public relations for the Simpson Timber Company at Seattle, Wash.

Oscar Levin, managing forester of Simpson Olympic Tree Farm since 1943, will succeed James as public relations director of Simpson Logging Company at Shelton, Wash. He will be assisted by James Hartley, who has been editor of the *Simpson Lookout* employee magazine, since 1958.

William S. Looney, with Simpson Olympic Tree Farm as assistant managing forester since 1948, will become managing forester of this organization, handling reforestation and land management on more than 200,000 acres.

Public

R. W. Harris Appointed to Northwest Station

Appointment of Robert W. Harris as chief of the Division of Station Management at the U. S. Forest Service Pacific Northwest Forest and Range Experiment Station was announced recently by R. W. Cowlin, director, Portland, Ore.

Harris will serve as the director's principal adviser on coordination and administration of regional research programs. He transferred from the Washington, D. C., office of the Forest Service, where he had been working in administration of national-forest range resources.

Harris was graduated from the University of Idaho in 1941 with a degree in forestry. He did postgraduate study at New York State College of Forestry in 1941-1942, and attended Navy radar schools at Harvard University and Massachusetts Institute of Technology while in the Service.

He is the author of numerous publications on range inventories and cattle management on western ranges, and is affiliated with the SAF and the American Society of Range Management.

Assistant Regional Forester At Milwaukee Named

Richard F. Droege, Supervisor of the Angeles National Forest, California, has been promoted and transferred to the North Central Region with headquarters in Milwaukee, Wis. He will be assistant regional forester in charge of information and education.

Droege, a graduate of the University of California, began his career with the U. S. Forest Service in Florida in 1936. He transferred to California in 1938 and progressed through various assignments to his most recent assignment of forest supervisor. He served on the Plumas, Stanislaus, Mono (Inyo), Lassen, Cleveland, Sequoia, Los Padres, and Angeles National Forests.

Mr. Droege's successor as supervisor of the Angeles National Forest will be Simeri E. Jarvi by transfer from the Forest Service regional office at Albuquerque, N. Mex. Jarvi served as supervisor of the San Bernardino National Forest from 1953 to early 1958. Prior to that time he had served in the regional office at San Francisco in the Divisions of Fire Control and State and Private Forestry. Other

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PHILIP A. BRIEGLEB (right), director of the Southern Forest Experiment Station of the U. S. Forest Service, New Orleans, La., is shown presenting a plaque representing the U. S. Department of Agriculture's Unit Superior Service Award to R. R. Reynolds, officer-in-charge of the Crossett Research Center. The Center has been in operation since 1934. Mr. Briegleb, acting for Secretary Benson, also presented individual employee certificates for personnel of the Center.

assignments have been in the Portland regional office and various forest administration assignments in Washington and Oregon. Jarvi is a forestry graduate of Oregon State College.

H. H. Morgan Retires

Howard H. Morgan retired November 1 as commodity specialist on lumber, logs, hardboard and paperboard from the Lumber and Paperboard Division of the U. S. Tariff Commission, Washington, D. C.

Mr. Morgan, born in Utah, reared in Pennsylvania, was a 1915 graduate of the Pennsylvania State Forest Academy at Mont Alto. Excluding Army service in World War I his early forestry career was spent in Pennsylvania in state work. During the 1930's he served as forester and camp superintendent of various CCC camps in the state.

In 1942 Morgan went to Washington and joined the Program Branch of the Lumber and Lumber Products Division of the War Production Board. Subsequently he held various positions with the Civilian Production Administration, the Office of the Housing Expediter, the Senate-House Joint Committee on Housing, and the Department of Commerce.

Morgan served as chairman of the committee on mathematics for the *Forestry Handbook*, published by the Society in 1956, and has been a contributor to the JOURNAL OF FORESTRY

New Forest Research Leader Appointed

Robert A. Ralston, research forester and leader at the Wausau, Wis. Forest Research Center, has been promoted and transferred to the U. S. Forest Service Central States Forest Experiment Station's Columbia, Mo. Research Center, Director W. G. McGinnies has announced.

Mr. Ralston received his forestry training at Colorado State University and the University of Michigan. During World War II he served four

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years in the Army, participating in the African and Italian campaigns.

Iler To Portland Post

James C. Iler has been appointed chief of the Division of Operation for the U. S. Forest Service Pacific Northwest Region, Portland, Ore., according to Regional Forester J. Herbert Stone. Prior to his transfer, Iler served in the chief's office in Washington, D. C., in various capacities after his transfer there in 1956.

Iler replaces P. F. Wallace Prater who recently transferred to Upper Darby, Pa.

A native of Oregon, Iler began his forestry career on the Mt. Hood National Forest in 1930 after graduating from Oregon State College School of Forestry. He served in various capacities on the Malheur and Umatilla Forests until 1938 when he was promoted and transferred to the Olympic National Forest in Washington as forest supervisor. In 1939 he moved to the Malheur Forest in Oregon as supervisor, and to the Mt. Hood in 1943.

Iler was transferred to Missoula, Mont., in 1947 as assistant regional forester. He remained in this position until 1956 when he was reassigned to Washington, D. C.

Schools

Alabama Polytechnic Institute Becomes Auburn University

Alabama Polytechnic Institute at Auburn officially became Auburn University on October 30 when the governor signed a bill of the legislature changing the name of the college to the one by which it has been popularly, though unofficially, known for many years.

Auburn is accredited for professional forestry instruction. Prof. W. B. DeVall is head of the Department of Forestry.

Montana Administration School Announced

Montana State University has announced that its 1960 Public Administration Leadership Development School will be held February 1-26. The teaching staff includes Arnold W. Bolle, associate professor of forestry at the University. Other staff members represent specialists in integrated areas of study.

Tuition for the course for college credit (7 hours) is $40, without credit, $30. Classes are limited to 30 students.

Inquiries regarding the course should be directed to Public Service Division, Homer E. Anderson, Director, Montana State University, Missoula.

Iowa State Staff Appointments Announced

Three new members have joined the forestry staff of Iowa State University of Science and Technology.

Dr. Frederick S. Hopkins, Jr., formerly on the staff of the New York State College of Forestry at Syracuse, became assistant professor of forest economics in September, replacing Dr. I. I. Holland who is now associated with the University of Illinois. Dr. Hopkins holds degrees from the University of Michigan and the New York State College of Forestry.

Dr. Carl J. Goebel joined the staff in August to lead the work in range management and to assist with research projects of the Iowa Agricultural Experiment Station. Prior to joining the staff at Iowa State, he was associated with the U. S. Forest Service in Region Four. Dr. Goebel holds degrees from the University of Idaho and Utah State University.

Robert J. Ethington joined the staff as an instructor in September to assist with the resident teaching program in wood technology and wood utilization. Mr. Ethington holds degrees from Iowa State with a B.S. from the forestry curriculum and an M.S. from theoretical and applied mechanics.

Arizona State Forestry Teaching Appointments

The Division of Forestry, Arizona State College, in its second year of operations with 90 students enrolled, announces the appointment of two new faculty members: Dr. Herb Ruckes, graduated from the New York Ranger School, received his B.S. and M.F. degrees from the State University College of Forestry at Syracuse University and the Ph.D. from Cornell University in 1955, majoring in Economic Entomology and Plant Pathology. He had been Research Entomologist at the University of California for five years where he worked on problems of seed and cone insects. Ruckes will teach forest entomology, pathology, and related courses.

Mr. Donald D. Dwyer received his B.S. and M.S. degrees from Ft. Hays,

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Kansas State College and has completed requirements for the Ph.D. degree in Range Management at Texas A&M. (He received the Phillips Petroleum Company scholarship for graduate study in Range Management.) Dwyer will teach courses in range management and game management at Arizona State College.

Foundation Sponsors Fellowships For North Carolina Extension Foresters

North Carolina State College's Extension Forestry Department recently received two graduate training fellowships to further a program for specializing staff members in problem areas vital to North Carolina's forestry development.

These fellowships amounting to $6,300 each are sponsored by the Richardson Foundation of Greensboro, N. C. They are made available through the North Carolina State College Foundation.

One of these fellowships has been awarded to Walter M. Keller, section head, Forest Management Extension. Keller will take graduate training in public administration and forest management at the School of Forestry, Duke University, Durham, N. C. While working toward a Master of Forestry degree, he will do research on the problem of staff assignments in extension forestry program organization.

The second of these two fellowships was awarded to Ross S. Douglass, Forest Management Extension specialist for southeastern North Carolina. Douglass will take graduate training in soils and forest ecology as these relate to site preparation and forest planting. He, too, will attend Duke and work for a degree at the Master's level.

Both of these men have been granted twelve-month study leaves of absence by North Carolina State College to take this specialized training. Both completed their undergraduate work in forestry with honors at North Carolina State College.

Purdue Schedules Forest Management Control Conference

The Department of Forestry and Conservation, Purdue University, is sponsoring a Forest Management Control Conference, February 15-17, 1960 at West Lafayette, Ind. The major purpose of the conference is to bring together recent developments in forest inventory and management science for discussion by foresters facing the problems that occur when continuous inventory plots are remeasured and when inventory data is put to work in management decisions. Work is under the direction of Dr. Otis F. Hall.

Registration is limited to 75; a fee of $20 will be charged. For information write Forest Management Control Conference, Dept. of Forestry and Conservation, Purdue University, West Lafayette, Ind.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Positions Available

LOGGING & FORESTRY EQUIPMENT SALESMAN

To aggressively promote dealership representing Michigan, Oliver and Huber-Warco in the central or northern areas of Maine. Age 25-35. Knowledge of equipment application desirable. Net earnings range from $7500.00 to $15000.00 per year. Hospitalization, life insurance programs, paid vacations are included. Alertness and aggressiveness needed. Send picture and resume to W. C. McCallum Portland Tractor Co. Inc., Portland, Maine.

Job available for young forester seeking opportunity for advancement. Work includes procurement, supervision of log and pulp contractors, and general Pine management. Applicant must have completed military obligation and should have Southern forestry experience. Beginning salary $450 per month. Write, giving full work experience details to:

Norman Martin, c/o Roy O. Martin Lumber Company, Alexandria, Louisiana.

Positions Wanted

Forester, B.S.F., 1956, Montana State University. Age 26, married. Experience: Two years continuous forest inventory, timber marking, scaling, cruising, boundary and road location. Desire position with private industry with opportunity for advancement preferably in the Southeast.

Box T, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., 1959, New York State. Married, 2 children. Held numerous positions of wide spectrum during years of schooling. One summer at U. S. Forest Service research center involving T.S.I., inventory and test sampling operations. Presently in park work in supervisory capacity. Desire to locate in western United States. Will consider offers from public or private organizations.

Box U, Journal of Forestry, Mills Building, Washington 6, D. C.

New high power! New low weight! Rugged production champ brings new lugging power to toughest big timber cutting!

Meet the Pioneer 600—all new from grip to tip, built and balanced for easy handling, comfortable cutting. New performance features mean real on-the-job dependability. Result: less down time, low maintenance, more profit for you.

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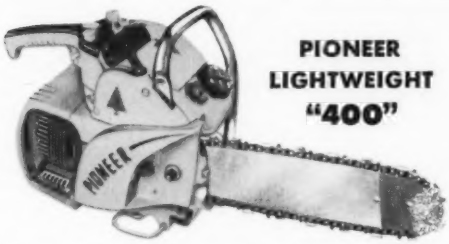

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